Study project Shouraizou

A survey on technical innovation in Japan compared to the Netherlands

Preliminary report

将来像

SHOURAIZOU

University of Twente
Department of Electrical Engineering
Study association Scintilla

Colofon

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IOP

Glimpse of the future

Young people travel all over the world. That is part of their fascination with this world and the attempt to discover real life. Traveling does not supply all the answers but it establishes the presence of the peculiar, the first step to knowledge and understanding. That is why it is important that students organize encounters with their contemporaries, broaden their perspective and deepen their experience.

Scintilla, the electrotechnical study association of the University of Twente set out to travel to Japan to study the state of the art of innovation. They named their project, auspiciously, Shouraizou: Image of the Future! and intend to conduct a first hand inquiry into the nature and developments of electrical engineering in Japan.

Japan has always appealed to the imagination of the technologically inclined. The quality of the products, the solutions in engineering and, let’s not forget, the attractiveness of design has created many *aficionado’s* of modern Japanese produce. Of course, Japanese society, its culture, economic and industrial system is different and thus it seems natural that the ‘outcome’ of the systems is different as well. At the same time, we are aware of the far-reaching impact of globalization and the multiple exchange of ideas and experiences. The domain of innovation is not immune for it as well and consequently the question arises: how much impact do endogenous systems and arrangements have on the outcome of the innovation process and ultimately, what does that mean for our own competitive position?

In this preliminary report we are presented with a systematic and solid analysis of the respective factors influencing the Japanese system of innovation, a necessary start for understanding the intricacies which reign the transformation of a new idea or invention into a marketable product. And this process is by no means static but subjected to the changes in Japan’s economic fortunes, the emergence of regional competitors and, of course, the production of new ideas and technology itself. Therefore, part two of the project, the final analysis in which the experiences and views of the new generation of Dutch electrical engineers will be portrayed, is awaited with great anticipation.

The thoroughness of preparation, the sophistication of approach and the enthusiasm in execution displayed already in this report, are the solid ingredients for a successful research journey and promise us an exciting *Image of the Future*, after return.

Prof. Dr. Joop A. Stam
Member of Board of Recommendation

Pulling together

Cooperation and teamwork: I would say that these two words echo through the history of Japan and the Netherlands. Like any partnership, the relationship between Japan and the Netherlands had its ups and downs, but trust and mutual admiration drew both countries closer to learn from each other. This cooperation lasts for generations; in schools Dutch children are taught that Japan and The Netherlands have a special relationship. The cooperation is not only shown in history lessons: multinationals like Philips and Sony collaborated in the early 80ś in the development of the Compact Disc. And now in present day Shouraizou will attempt to discover the similarities and the differences between both countries.

The spirit of cooperation and teamwork has also inspired two student associations to pull together and support the Shouraizou committee. I am referring to the two electrical engineering associations E.T.S.V Scintilla and the IEEE Student Branch Twente. Although I am a board member of both organisations, it is still remarkable that these two organisations work so well together in supporting the committee.

In the past, both organizations have already cooperated in organizing study projects and symposia. Take for example the last study project ShinTabi, which took place in the year 2000. Back then, participants visited Asian countries that were prominent in the field of embedded systems. The big difference between the previous and the current project is the size; this time it is larger and thus more expensive. Although we have full confidence in the capability of our committee, both factors create a more aware and conscious atmosphere for the board members of both associations.

Also as a participant of this project, I have experienced at first hand what teamwork means: working together with 34 other participants to write this report and working hard at the contract researches to collect the financial means to finally bring this study tour into practice.

So I conclude with my opinion that the power of working together has no bounds; mankind can accomplish anything if people pull together.

Janarthanan Sundaram
President of E.T.S.V. Scintilla
Secretary of IEEE Student Branch Twente

Vision in action

"Vision without action is a daydream ..."

This first part of an ancient Japanese proverb probably resembles best what our study project is all about. People have their vision of the future, or in Japanese, a 'shouraizou'. But what would this vision be without the action to realize it? It is generally believed that innovation should be a keyword in the vision of our future. Although there has been much discussion about this in Dutch society and politics recently, many think that the vision is turning into a daydream, due to a lack of action. They refer to Japan as an example of how one should deal with innovation. This has been an inspiration for our survey into technical innovation: creating a vision of the future and more important, discovering what we can do to turn this vision into reality.

It was already clear from the start of the project that a study tour to Japan should be part of the project. But what should we do to prepare ourselves, to be able to put the right questions and address the relevant topics? This preliminary report is our answer to this question. Participants have performed research on the subject of technical innovation in Japan and compared this with the situation in the Netherlands. They have not only focused on macroscopic factors in economy, politics and society, but also investigated several sectors specifically.

"... but action without vision is a nightmare."

The Shouraizou committee has put many efforts in the organization of the study project. However, all these efforts may have turned into a nightmare, without a vision on the study project. We have spent almost a year to develop our vision with the help of many people. First of all, we would like to thank the members of our Board of Recommendation, who supported the project not only with their name, but also with useful advice and contacts. Moreover, we are grateful to our supervisors and lecturers, as well as the (associate) professors that will travel with us during the study tour. Finally, the project would not have been possible without the companies, institutes and universities that have shown interest in the project: those in Japan, that will welcome us during the study tour, as well as those in the Netherlands, that support the project financially and in many other ways.

The committee is looking forward to the second part of the project: the study tour to Japan and the conclusion of the research project, to be ended with the final report. We are confident that with the help of all participants, we will have a great time and it will be a great success!

Roland Meijerink
Chairman of study project Shouraizou

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Chapter 1

General introduction

Chapter contents

1.1 Introduction

In this chapter, the study project will be introduced. In section 1.2 you will find more information on the goals, theme, name and the various parts of the project. Section 1.3 will introduce the organizing committee and the associations Scintilla and IEEE SB Twente and the University of Twente. Next the project participants, as well as the supervisors and lecturers will be introduced in section 1.4. The chapter is concluded with an overview of the contents of this report.

1.2 Study project

This section contains general information on the study project. In the first subsection, the various goals of the project will be indicated. After that, the theme and the country that are the subject of our investigation will be presented. Subsection 1.2.4 explains the Shouraizou name and logo. Finally, a general outline of the entire project and a brief description of its various parts will be given.

1.2.1 Goals

When the Shouraizou committee started with the organization of the study project, they had several goals in mind. Some of the goals that the committee would like the participants to achieve are:

- Get to know a non-European country from 2 different views:
    1. study of culture, climate, politics, geography, language, economy, social aspects, etcetera;
    2. study of activities in Electrical Engineering - the level of education, research and the ways they are implemented;
- Learn some of the aspects from the work of an electro technical engineer, within a company in a non-European country;
- Get to know people in companies, research institutes and universities, both in the Netherlands and abroad;
- Gain some knowledge in a working area of Electrical Engineering.

1.2.2 Theme

The Shouraizou study project aims to investigate technical innovations in Japan, in industry, universities and research centers and compare this with the situation in the Netherlands. There has been a lot of talk about ‘innovation’ (knowledge-based changes in products and processes, in industry, technology and science) in Dutch society and politics recently: there is much worry about a lack of innovation and knowledge in our country, which resulted for example in the foundation of the Innovation-platform, with Prime Minister Jan-Peter Balkenende, several ministers, representatives of major Dutch companies and the Rector Magnificus from the University of Twente. But why did we choose for technical innovation as the theme of our study project?

It is our vision that people have spent enough time on discussion of and research into innovation: it is time to have things done. Aim of the project is to show a group of future engineers what, where, why and how people are innovating, so that they learn what innovation is. Not by just researching it, but by seeing it with their own eyes. In this way they learn not only that innovation is important, but also how they should use it in their future careers. Moreover, we believe that innovation is closely related to both activities in Electrical Engineering, education and research, and culture, economy and social aspects. Participants will study all these factors for Japan and will get to know this country from the different views described in the previous subsection.

1.2.3 Country

Having said that the project is organized at the Department of Electrical Engineering and that its theme is technical innovation, very few words have to be spent on the decision to let the project focus on Japan. Being one of the most innovative countries in the world for the last decades, Japan is globally well-known as a high-tech country, with a lot of interesting products and services to be seen in companies, institutes, universities and (more than anywhere in the world) everyday life. However, an even better reason may be the enormous attracting power of its mystic language, intriguing culture, astonishing nature and friendly people.

1.2.4 Name and logo

The project is called 'Shouraizou', which is the Japanese word for 'vision of the future'. This name covers the goal of the project as explained in subsection 1.2.1, which is to show participants what innovation is and what they can do with it themselves. During the project we want them to see, experience and create a vision of the future.

It did not take us much time to come up with a logo. The eye, a universal symbol for vision, combined with the Japanese flag, in our opinion explains very briefly and clearly what the project is about.

1.2.5 Project outline

The study project Shouraizou consists of several activities, that can be divided into 3 groups.

Main part is the research project, a survey on technical innovation in Japan, compared to the Netherlands. This research is carried out by the participants under supervision of academic staff members, using lectures, presentations and assignments. Since one cannot find everything in books, the study tour to Japan will plan an important role.

Secondly, the study project consists of several cultural activities. As a preparation before the tour, participants have watched Japanese movies and have had Japanese dinner. Most participants also followed an extensive language course. Most cultural activities of course will take place during the study tour in November 2004: we will experience everyday-life in Japan and visit a lot of places that are well worth seeing.

The last part of the project is less focused on Japan: participants have performed so-called contract research assignments for companies and universities in the Netherlands. These assignments are primarily essential for the funding of the study project.

1.3 Organisation

Shouraizou is a project organized by a committee at the University of Twente, founded by Electrical Engineering study association Scintilla and endorsed by IEEE Student Branch Twente. More information on these organizations can be found in the following subsections.

1.3.1 Shouraizou committee

The Shouraizou committee was founded in the summer of 2003, when some active members of study association Scintilla decided that, after the huge success of predecessor ShinTabi in 2000, it was time for a new study project to start. It consists of 7 enthusiastic, ambitious and very expierenced Electrical Engineering students, that voluntarily spend one and a half year of their study time on the organization of the study project.

The members of the committee are (in alphabetical order):
Bayan Babakhani - Treasurer
Siebe Berveling - Research Manager
Arjen Damstra - Public Relations Officer
Johan Engelen - Travel Coordinator
Roland Meijerink - Chairman
Erik Staijen - Administrator
Martin Wassink - Contract Research Manager

A picture of the entire committee can be found in figure 1.1, pictures of the individual committee members are presented in subsection 1.4.1.

1.3.2 Study association Scintilla

E.T.S.V. Scintilla is the study association for the Department of Electrical Engineering at the University of Twente. It was founded on 9th September 1965 and

Figure 1.1: The Shouraizou committee (from left to right: Bayan, Martin, Johan, Arjen, Siebe, Erik and Roland

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currently has over 700 members, of which more than 400 are students in Electrical Engineering. This makes Scintilla one of the oldest and biggest associations at the University of Twente. Its name is derived from the flashes that can be seen, when small particles collide with a fluorescent plate.

As stated in the articles of association, Scintilla has the following goals:

- Expand the practical and theoretical knowledge of its members in the field of Electrical Engineering;
- Look after the interests of students Electrical Engineering at the University of Twente;
- Support the course of business in the education of Electrical Engineering;
- Improve the mutual contacts between its members.

Nowadays, the association is run by more than 100 active members that participate in committees and working groups, including a board of 6 students that are doing this full-time for one year.

Scintilla's activities can be divided into 4 main areas: study-related activities, publications, facilities and others.

Study related activities

Every month, Scintilla organizes an excursion to or a lecture given by a company that is of interest for its students. These excursions and lectures offer students the opportunity to get in contact with companies that could be their future employer.

Besides these monthly activities, an annual symposium is organized. On this day, interesting speakers from the Netherlands and abroad focus on a specific area in the field of Electrical Engineering.

Publications

About 8 times a year Scintilla sends out a semi-scientific magazine to keep members informed of research at the Department of Electrical Engineering, developments in education, activities of the association and much more. Moreover, every year a yearbook is published, to give an overview of the developments and activities of the past year.

Facilities

Scintilla has its own room at the university campus that not only provides workspace with computers and a conference room, but also is the most important meeting place for students during breaks, to have a cup of coffee. Scintilla also runs a small pub, where students and academic staff members can have a drink at the end of the week and discuss their experiences with each other. Finally, Scintilla has its own store, which sells electrical components, study books, computers and office supplies.

Others

There are numerous committees that do not fit in one of the previous areas. This includes committees that organize recreational activities, maintain the computer network, organize special introduction days for the freshmen at the start of the year and much more.

1.3.3 IEEE Student Branch Twente

The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest technical professional society. Founded in 1884 by a handful of practitioners of the new electrical engineering discipline, today's Institute includes 77,000 students within a total membership of nearly 377,000 members, who conduct and participate in its activities in 150 countries. IEEE-members are technical and scientific professionals making the revolutionary engineering advances, which are reshaping our world today.

The technical objectives of the IEEE focus on advancing the theory and practice of electronics, electrical engineering, computer engineering and computer science. To realize these objectives the IEEE has a worldwide representation through more than 1200 Student Branches and chapters.

IEEE sponsors scholarships, awareness programs, technical conferences, seminars and local meetings. Furthermore the IEEE publishes over 30% of the world's scientific literature in its field of interest and provides educational programs to keep its members' knowledge and expertise state-of-the-art.

World-wide, the IEEE operates in 10 geographical regions, subdivided by Sections in which local chapters and student branches organize activities. The Student Branch Twente is located in region 8, which roughly consists of Europe, Africa and the Middle-East. Next to annual conferences, technical meetings and other professional events, there are several student activities like the Region 8 Student Paper Contest, a two-year Student Branch Congress, awards-, scholarship- and exchange programs.

The IEEE Student Branch Twente was officially founded in 1989, but there are reports of branch activities that date back to 1968, only 7 years after the University of Twente was founded. Current activities of the Student Branch Twente include:

- Promotion and support of IEEE Membership at University of Twente;
- Organization and support of international events and study projects, mostly in co-operation with fellow student organizations;
- Helping students to find an internship, exchange program or other practical assignment abroad using the IEEE world-wide network;
- Participation in Region 8 activities (e.g. R8 Student Paper Contest, Student Branch Congress).

1.3.4 University of Twente

The University of Twente (UT) in The Netherlands is a young and entrepreneurial research university. Founded in 1961 and situated in the eastern part of The Netherlands, the university offers education and research in a wide range of engineering, behavioural, medical and social sciences. The education programmes of the university - 20 Bachelor programmes and an even larger number of Master's programmes - are acknowledged as the top of higher education in the Netherlands. The Electrical Engineering programme, for example, scored the highest rankings in recent polls among students and scientists. UT's unique campus offers a vast number of facilities to 7000 students and 2500 staff members, including modern research labs, fast internet connections, up to extensive sports facilities and student/staff houses.

In research, University of Twente has chosen a limited number of technology spearheads, in which the university wants to excel. UT's largest research institute is the MESA+ institute for nanotechnology, responsible for the largest Dutch nanotechnology programme. Other spearheads are information technology, biomedical technology, mechanics, processes and control. UT's research institutes aim at over 50 percent non-government funding and therefore closely cooperate with industrial partners.

'Entrepreneurial' is the keyword for the attitude the university is facing towards both education and research. The university was founded to become a key player in turning a post-industrial region into a truly knowledge-intensive one. UT is therefore always open for close relations towards society. The university actively stimulates entrepreneurship among students and staff, for example by offering them facilities for starting their own company. In research, UT is a partner for large companies, SMEs and government organizations. It participates in European and worldwide research projects.

In education, this entrepreneurial attitude means that UT is always in the forefront of introducing the newest educational concepts. In this way, a UT-student gets the best possible luggage for a career in industrial, scientific and other organizations.

1.4 People

Several people from the University of Twente are active in the study project. In total there are 35 Master students involved, of which 7 are responsible for the organization of the entire project. Moreover, there are several academic staff members involved. These people will be introduced in the following subsections.

1.4.1 Committee

The members of the Shouraizou committee are presented in table 1.1.

1.4.2 Participants

The 35 participants of study project Shouraizou are all Master students in Electrical Engineering at the University of Twente. Some of them have only recently started their Master, whereas others have almost finished their thesis. The students are introduced in tables 1.2 and 1.3.

1.4.3 Supervisors

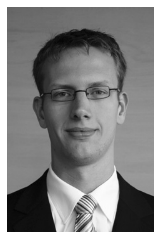
There are several academic staff members that play an important role in the study project. Some of them supervise the project and give lectures, whereas others travel with us during the study tour. These people are presented in tables 1.4 and 1.5.

Bayan Babakhani
Treasurer

Siebe Berveling
Research Manager

Arjen Damstra
Public Relations Officer

Johan Engelen
Travel Coordinator



Roland Meijerink
Chairman

Erik Staijen
Administrator

Martin Wassink
Contract Research Manager

Table 1.1: Shouraizou committee members.

		
Frank van der Aa	Jos Ansink	Casper van Benthem
		
Bert van den Berg	Maarten Bezemer	Niek Bouman
		
Lodewijk Bouwman	Pieter Cuperus	Eelco Dalhuisen
		
Bertjan Davelaar	Michel van Dijk	Michel Franken
		
Thomas Janson	Joost de Klepper	Jasper Klewer

Table 1.2: Shouraizou participants.


Matthijs Krens


Sebastiaan van Loon


Mathijs Marsman


Paul Omta


Laurens van Oostveen


Harald Profijt


Dirk van Schaijk


Martin Schepers


Casper Smit


Bart Spikker


Janarthanan Sundaram


Rogier Veenhuis


Kasper van Zon

Table 1.3: Shouraizou participants.

Dr. Ir. S.J. de Boer
International Management

Prof. Dr. Ir. J.J. Krabbendam
Technology & Organisation

Prof. Dr. J.A. Stam
Technology & Organisation

Table 1.4: Study project supervisors and lecturers.

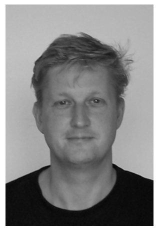
	
Dr. Ir. L. Abelmann Systems and Materials for Information storage	Prof. Dr. M.C. Elwenspoek Transducers Science and Technology
	
Prof. Dr. J.C. Lodder Systems and Materials for Information storage	Prof. Dr. Ir. A.J. Mouthaan Educational director Electrical Engineering
	
Prof. Dr. Ir. B. Nauta Integrated Circuit Design	Prof. Dr. Ir. C.H. Slump Signals and Systems

Table 1.5: Study tour supervisors.

1.5 Report outline

The structure of this reported resembles the outline of the project as depicted in subsection 1.2.5.

The first part deals with the main part of the project, the research project. It contains an introduction to the research project and subsequently an explanation of its set-up in chapter 3. The results of the survey on technical innovation are presented in chapter 4, whereas the results of macro and meso-research on Japan are presented in respectively chapter 5 and 6. Part I is concluded with a preliminary conclusion in chapter 7.

The second part of the report contains the other parts of the study project: both the cultural activities (chapter 10) and the contract research assignments in chapter 9 are presented. Moreover, a brief overview of the tour schedule for the study tour is given in chapter 8.

PART I

RESEARCH ACTIVITIES

Chapter 2

Abstracts

Innovation is more and more recognized to be important for our future. The purpose of the study project Shouraizou is to obtain a better understanding of innovation, by looking at technical innovation in Japanese society and industry and comparing this to the situation in Dutch society and industry. In order to get this better understanding, the following research question was put: “What definition of technical innovation and its characteristics are appropriate for our research?” This preliminary report of the research project contains a survey on technical innovation and a study of the environment, at macro-economic level as well as on meso-economic level, in which this innovation takes place.

2.1 Technical innovation

Technology has a number of meanings, varying from ‘products’ to the various disciplines of science and engineering. Technology development is the outcome of activities of human beings and thus sensitive to culture. Innovation means ’to make new, to renew or to alter’. The concept can be separated in two parts: development and diffusion. Innovation can be found in both product and process developments. This survey on technical innovation contains both development and diffusion, but is confined to products and processes as far as they involve technological advancements. Innovations can take on many shapes and forms, be it a new technological breakthrough, a refinement of an existing technology, or the application of a technology to create a product. Technological changes are described by an s-shaped curve in which the emergence phase and the incremental phase are distinguished.

The environment in which innovations take place consists of three levels: the general (or macro-economic) environment, the industrial or competitive environment (or the meso-economic level), and the task environment (or the micro-economic level). At the macro-economic level political, economic, social-cultural, technological, geographical and historical actors can be distinguished. At the meso-economic level institutions can be classified along two dimensions: private versus public institutions, and institutions that develop versus institutions that facilitate. Both levels are investigated in this report.

In order to create a good micro-economic environment for technological advancements, institutes have to define a technology strategy. A main input factor for determining a proper technology strategy is the environment at all three levels. Technology strategy is the revealed pattern in the technology choices of firms. The choices are influenced by the fundamental objective of the firm, its possibilities in the environment and the available resources. The execution of the technology strategy involves the appropriation of certain technologies, the deployment of technology in products and the deployment of technology in the value chain. The organization of technology in firms has had a shift of focus from technology-only to marked-oriented as well. Several organization structures are discussed.

2.2 Macro research

Socio-cultural, technology, history and geography

These four sections gives a wide angle, historical, view of Japan. Starting with the tectonics it will show how volcanoes formed the country and how geographical aspects like the location, the shape of the countryside and the geographical location have acted as both advantages and disadvantages on building the current Japanese civilisation.

After geography the history of Japan is summarized. Japan has always been a very closed country and formed a very specific culture. Although they have imported some habits from abroad, like the Chinese writing and Confucianism, Japan has always proven to be able to adapt these habits to their own culture. The Japanese are also very curious towards new technology. This curiosity made Japan one of the most technologically developed countries in the world.

Both history and geography have formed the Japanese culture to what it is today. This culture is very different from our own culture and also the businessculture of Japan is very different from ours. Japanese see themselves as a member of a group (their family, their business) and decisions are made by the group, never as an individual. The mostly male employees usually work their whole life for the same company and a dismissal is such a big shame for a man that he might not return to his family after he is dismissed. Because the Japanese culture differs so much from ours it might be hard to understand the way businesses act. This chapter will give some basic information and will help to better understand the rest of this report.

International economics

The international economy has a great influence on Japan. It contributed to its success and to the cause of its recession. Japan is historically a closed nation, both in culture as in foreign relations. After World War II a new foundation was laid on which it prospered to become the second largest economy in the world. Japan has opened up to some extent and improved its trade relations with the US, Europe and the Asian region.

After decades of miraculous economic growth Japan was hit hard in the recession of the 90s. It is referred to as the lost decade, because the growth in the last ten years is negligible. Major reforms will be carried out in an effort to escape the stagnation and hopes are high that they will be successful. The US has always been a valuable trading partner but in recent years the focus is shifting to the East. Of all the major economies in the world, only China has seen dramatic improvements. If Japan wants to remain a world economic leader it must overcome its historical differences with its neighbor. The Netherlands have seen a large growth in the 90s but is currently in recession.

Free trade and globalization are important to economic prosperity. To realize this, Japan is a member of global and regional trade organizations to combat fraud and stimulate harmonious legislation. The formal trade barriers are almost non-existent, but cultural differences and local laws pose a more elusive barrier that hinders foreign competitors and investors. The Netherlands also exploits the benefits of cooperation in regional and global trade organizations but the Netherlands has few trade barriers.

Japan has a large surplus on its trading and investment balance. The imports and exports changed in nature since 1970, because the share of finished goods in imports has risen to the level of other developed countries. Although Japan penetrated technology intensive foreign markets, the sales of imported precision machinery rivals the domestic sales. Direct foreign investments made by Japan are increasingly done in Asian countries, but investments in the US and Europe are still considerably higher. The Foreign Direct Investments (FDI) in the Netherlands are as high as in Japan, but the inward and outward investments are more balanced. The imports and exports of the Dutch are half of that of Japan, while the Gross Domestic Product (GDp of Japan is ten times higher than that of the Netherlands.

Japan and the Netherlands both have technology intensive exports with a technology rate as high as one third. Although Japan invests more in R&D, both countries score equal points on the innovation scale. In general innovation is a key element in the international trade of both economies

National economics

The general situation in Japan is that currently the economy is growing, however at a very slow rate. The GDP/GNP currently is growing with 1% a year and this is quite small for stimulating innovation. Interest rates have always been low but are now virtually zero to motivate people to spend their money. The deflation however is inhibiting this effect because money will be worth more tomorrow even with a zero interest level. The lack of demand for product is also inhibiting innovation, but the low interest rate should stimulate companies to innovate since funds are cheap. The Bank of Japan is currently enlarging the money supply to decrease the deflation and maybe even get some inflation and thereby encouraging consumption again. From this the conclusion can be drawn that the economic situation is of strong influence on innovation. Unemployment is also becoming a problem. This causes people to limit consumption since it is uncertain if they will keep their job and thus their income. The income of people with a job has been very stable for the last 30 years and this is a comforting thing for the working class. When we look at the theory of business cycles combined with past developments we can conclude that the economy will pick up and start to grow. From this we can conclude that although the Japanese economy is not doing very well at the moment, it will do so in the future. This will also be a stimulation for innovation.

National politics

After World War II, Japan became a democracy with a similar structure as seen in most Western countries: a parliament (Diet), cabinet and ruler. The government can be seen as a very high prestige company whose job it is to oversee and regulate. Due to this professional attitude Japan in the past thought beyond the conventional ways and employed policies leading straight for improvement and innovation. Nowadays, Japan and the Netherlands are both reducing regulations that hinder companies to innovate. Support is more and more given as competitive support, also pushing universities and institutes to acquire funding from the private sector. The policies of the Japanese and the Dutch governments are alike with regard to these aspects. But in the last decade the contribution of the Dutch government to the national Gross domestic Expenditure on Research and Development (GERD) is decreasing, whereas Japan is trying to increase its contribution. The Japanese contribution to the GERD is lower than the Dutch share. This is even without the increasing support of the EU. The GERD of the Netherlands is about 2% of GDP and, within the EU, the Netherlands have signed an intention to achieve a GERD of 3% of GDP. Whereas Japan, having a GERD of 3% already, is trying to increase it and they are also trying to increase the role the government plays in it.

As with most countries, the environment comes after economy. Both countries show detailed plans of how they want to preserve the environment. Those regulations, like on carbon emissions, nitrate or waste production, can and sometimes do severely limit companies in their capacity to function with maximum economic efficiency and thus innovation. The Netherlands promotes a somewhat more active environmental regulation than Japan.

Corruption can cause several problems on economic, politic and social matters. Innovation can also be hindered by corruption. The Transparency International CPI indexes the rate of corruption of countries. The Netherlands shows less corruption than Japan. Bureaucracy is an important factor for slowing down the making of decisions and the arranging of things. This can affect innovation in a bad way. Japan and the Netherlands have a slow bureaucracy. Freedom of speech and human rights are important factors of innovation. Freedom of press is on the base of creation of knowledge and innovation. Citizens in Japan and the Netherlands are treated in a right way, with respect to the human rights. The freedom of press is high in the Netherlands and not very high in Japan, but not bad. This statement is based on the second World Press Ranking of Reporters without Borders.

International politics

On both bilateral and multilateral level relationships are important for Japans economic ties and safety, which are important for innovation. The bilateral relations are discussed with the relations with other countries and the multilateral are discussed with the international organizations.

The relationship with other countries has changed during over the centuries. In 1600 the Netherlands already had relations with Japan, but these relations were lost in 1900 through the new foreign policies of Japan. After World War II Japan became dependent on the United States by the Treaty of Peace. This led to an international politics focus of Japan on its economic market and the relations with surrounding countries for trading.

Although Japan is still dependent on the United States for its security and economy, it has become more independent through the years. For resources Japan has become less dependent on Western powers, which can stimulate the production of innovative products.

Japan spends a lot of effort and money in supporting other countries in Asia by joining international organizations like the UN, WTO, World Bank, IMF, Colombo plan and the Asian Development Bank. It also finances organizations like the ASEAN. A reason for this is because Japan is dependent on the raw materials it gets from these nations and the Japanese government therefore wants a stable, peaceful world economic market.

The Netherlands and Japan are trying to repair the relationship between the two countries by supporting and funding organizations that promote companies or opportunities for exports of goods and technology as well as for investment in the both countries.

All these factors stimulate the companies and organizations in both countries to invest and to explore their markets to deploy new innovations. Both governments want their markets to trade and invest in a stable economic market.

2.3 Meso research

This chapter is about the meso analysis carried out as a part of the study tour to Japan. Japan and the Netherlands are compared on meso economic divisions according to the ISIC Rev.3.1 division definitions. The five analyzed divisions are:

- Division 31: "Manufacture of electrical machinery and apparatus n.e.c";
- Division 32: "Manufacture of radio, television and communication equipment and apparatus";
- Division 33: "Manufacture of medical, precision and optical instruments, watches and clocks";
- Division 73: "Research and development";
- Division 80: "Education".

The divisions have been analyzed with Porter's Diamond. This model is a powerful and systematic way to evaluate the industry's ability to be competitive and innovative.

Division 31

Japan and the Netherlands are different, with respect to the situation of the industry in ISIC division 31. The Netherlands shows more innovative activity, but this may change greatly in the future. The export and import are relatively much larger in the Netherlands, due to the fact that the Netherlands is in fact a trading nation. This is good for the development of this division of industry. Japan has an advantage in the higher productivity of its employees. Japan has been compared to the Netherlands, even though Japanese production is about 200 times greater and the Netherlands are EU-wide a small player in this section of industry. A recent innovation which belongs to the electric equipment division is a new type of electric motor. The usage of permanent magnets in these motors results in a high efficiency over a wide speed range. Because of this, this type of electric motor is used in many new applications. Since during the study tour there will be a visit to Showa Shell near Tokyo, a manufacturer of photovoltaic cells and modules, this survey includes a part about solar technology. Currently, Japan is the world's biggest producer of solar cells and modules.

Division 32

In division 32, mainly the consumer electronics industry in Japan and the Netherlands have been analyzed. The conclusion from this analysis is that the concerned industries in Japan enjoy better conditions to be competitive and innovative compared to the Netherlands. The most interesting field in this division is the consumer video equipment division, which shows very promising growth numbers, especially LCD screens. Therefore, hot innovation topics concern advanced display technologies and these are being developed in Japanese as well as in Dutch companies.

Division 33

Division 33 is the division that includes manufacturing of medical devices, measuring and testing instruments and process control equipment. Some of the findings are that the Japanese government is working very hard to improve the economy, and is therefore trying to stimulate international trade, and that the Netherlands most of all appear to be a gateway for the distribution of equipment. Some hot innovations in this division are a newly developed chip to measure the blood sugar level, the world's first bio-sensor, a virtual reality operating theater, smart sensors and the use of manipulation systems that are based on simple hardware elements performing simple physical actions.

Division 73

Division 73 is the division of research and experimental development on natural sciences and engineering. Japan faces a hard economical climate at the moment, but because government and industry are sensitive for the argument that innovations bolster a country's economic growth and competitiveness, in recent years Japan started initiatives to create innovations. To make it as easy as possible for institutes the Japanese Patent Organization tries to improve procedures and reduce wait time by requesting patents. In Japan, much research and development is done. Besides companies, this work is done by research institutes at a high level. The government gives high priority to research and development and tries to stimulate this as much as possible. They are working hard to get a larger technological advance in relation to the EU or the US. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) has three bureaus which are involved in the division research and development. The main problem in Japan is that until now, they focus too much on development. Basic research is not good developed and this could become a problem. Although the Netherlands used to be a leader in innovative products, the Dutch are nowadays just followers and have to be careful not getting too far behind. The Netherlands profiles itself as an innovative leading country, however this is not the case. It is furthermore inevitable that, if the Netherlands continue its current policy, they will get further behind. However, a link has to be created from the basic research to final products and at the moment that link is missing.

Division 80

Division 80 is about education. The main difference between Japan and the Netherlands is that, in general, the level of education in the Netherlands is higher. In Japan, there are almost no universities like the Dutch ones. Most universities in Japan are considered 'HBO' level with the exception of some national (Tokyo and Kyoto) and private institutions. The Junior Colleges are comparable with 'MBO' level. That is also the reason that it is not very interesting for European students to study in Japan. It may be interesting in a cultural sense but the educational value would not be as high as in Western countries. Furthermore, the

Dutch higher education is more involved in technical innovation than the Japanese higher education. The reason for this is that the Dutch students perform most assignments inside their university, while Japanese students perform them inside a company. Although most universities in Japan are private institutions, the Japanese higher education is not very market-oriented and flexible. The national universities have to shift their focus from high standards and status towards competitiveness and market oriented thinking if they want to survive the economy of today.

Chapter 3

Research introduction

This introduction first points out why the research project was set up. Then, the project's aim and the research questions are formulated. The way we performed the research project is set out next, and finally, it is explained how the subsequent chapters in this report are linked to each other.

3.1 Project window

'Innovation' has become a hot topic over the past years. Its importance is more and more recognized by governments. The European Union wants to establish a European Research Area [1, 2] and to have the European R&D expenditures equal to 3% of the gross domestic product [3]. In extent to this, the Dutch government has established the Innovation platform [4], which is one of their measurements in order to achieve their goal to become one of the leading researching countries [5]. In the Innovation platform, government, university and company representatives discuss the innovation process and suggest desirable adjustments to the Dutch policy. The Netherlands, and Europe in general, seem lagging behind in research and development compared to Japan. A lot of high tech products are of Japanese fabric instead of Dutch (or European). This research project contains the search for differences between these countries that are responsible for this.

3.2 Aim of the project

The purpose of the study project 'Shouraizou' is to obtain a better understanding of innovation, by looking at technical innovation in Japanese society and industry and comparing this to the situation in Dutch society and industry. The project's aim can be formulated as: to identify the most important factors that affect the level of technical innovation in Japan and in the Netherlands.

3.3 Research questions

The project's aim is translated into a main research question. This main research question is:

> (i) *What are the key factors that influence technical innovation in Japan and the Netherlands?*

Technical innovation, the term used in this research question, is a wide concept. Therefore it is necessary to make clear what definition of technical innovation is appropriate for our research project. The key factors mentioned in this research question are investigated on the macro-economic level, the meso-economic level and the micro-economic level. Therefore the research project is splitted in four parts, as can be seen in figure 3.1. Each part has its own research question.

The first part contains an investigation into the concept of 'technical innovation'. First aim of this part is to get to know which topics innovation, technological innovation and technical innovation include. The second aim of this part is to point out several characteristics of innovation that are relevant to our research. This is formulated in a research question:

> (ii) *What definition of technical innovation and its characteristics are appropriate for our research?*

The second part of the research project contains the macro-level research. The macro-economic level contains factors that play on the national as well as the international level. In this pat it is pointed out what factors at the macro economic level are present and how they influence innovation. Of course, these factors will appear to be different for Japan and the Netherlands. The specific research question for this part is set to:

> (iii) *What are important forces in society that support or inhibit innovation on the national and international level?*

The aim of the third part of the research project is to search for factors in the relationship between enterprises and their environment which influence technical innovation. These relations play at the meso-economic level. Enterprises are grouped into divisions based on similar output activities. A lot of divisions exist. Our research is confined to divisions, in which electrical engineering plays an important role. The research question that is put at this level for the selected divisions is:

> (iv) *Which fields of Electrical Engineering are of interest in the division and what are hot innovation topics in that division?*

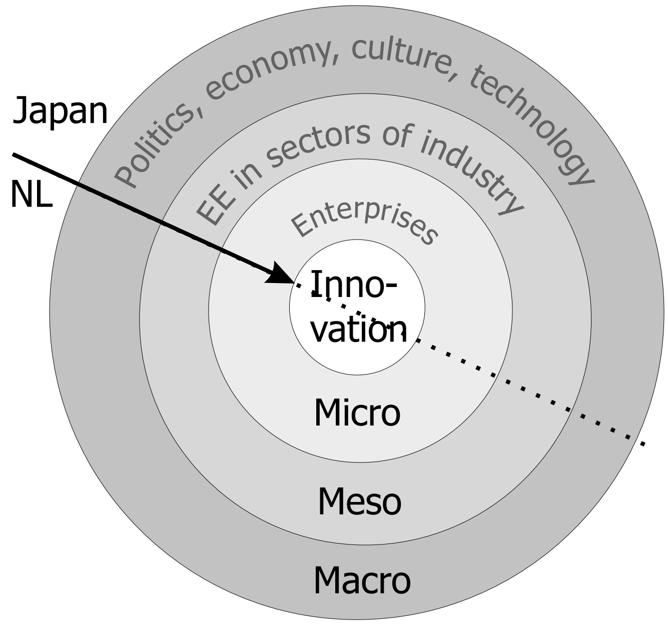


Figure 3.1: Model of the research project.

The fourth part of the research project contains a micro-level investigation. The aim is to find out which factors play a role in companies, universities and institutes, and if the factors that play at higher economic levels influence technical innovation at the micro level. This is formulated in the following research question:

> (v) *What factors support or inhibit technical innovation on the organizations' level?*

3.4 Realization of the project

The four parts of research are depicted in figure 3.1 in which every shell corresponds to one part. The research project was performed by several lectures, presentations and assignments. First the core concept of the research project, technical innovation, is made clear in the theme investigation. Then, this concept is approached from the outside passing through the three levels. The macro and meso level research are performed in parallel, after the theme investigation. The fourth part, the micro-level research, is based on company visits in both the Netherlands and Japan. The visits in Japan form the main part of the study tour that will take place in November 2004. The theme investigation, the macro-level and the meso-level research are preliminary to this tour. Thus, this preliminary report of the study project contains the results of the first three parts of the research project, in order to prepare both participants and companies that will host us.

Additions to the research project

In addition to this research set-up, participants were encouraged to attend the lectures by prof. dr. Stam on ‘Organization and management in Japanese Enterprises’. Another addition to the research project was a course on the Japanese language in which most participants participated. This course is one of the cultural preparations to the tour. More on these preparations can be found in part II of this preliminary report.

Support

The activities within the research project were supported by the scientific staff of the faculty of Business, Public Administration and Technology, especially dr. S.J. de Boer of the Technology Development Group and prof. dr. J.J. Krabbendam of the Technology and Organization group (T&O). The relevance of this research project to our participants, who are Electrical Engineering students, is recognized by the department of Electrical Engineering: the courses that are part of the research project can be fitted into the Electrical Engineering curriculum of the participants.

3.5 Part outline

The research part of this preliminary research consists of chapter 3 through 7. In chapter 4 the results of the theme investigation are presented. In chapter 5 the results of our macro-level research are given. Next, in chapter 6 the meso-research results are given. In chapter 7 a preliminary conclusion is presented, which is useful for the fourth part of the research project, the study tour to Japan.

The contents of these chapters are written by all participants. The names of the authors are mentioned at the start of their text.

Chapter 4

Technical innovation

Chapter contents

4.1 Introduction

Although almost every developed person will recognize the word innovation, it is not trivial to explain the concept. What does it mean, how can you describe it in a clear, short, but sufficient way?

This chapter outlines the process of innovation and the managing of technology development. It searches for an answer on the question:

> *What definition of technical innovation and its characteristics are appropriate for our research?*

These characteristics might be different for innovation processes in Japan and the Netherlands. Narayanan's book 'Managing technology and innovation for competitive advantage' [6] was the guideline for this chapter.

In the first three sections of this chapter we present the concepts of technology and innovation and describe the innovation process. In the fifth section, a brief overview of the technology environment, in which innovation processes take place, is given. The sixth section then continues with the monitoring of the technology environment and the constitution and execution of an appropriate technology strategy regarding the environment. The seventh section continues on the organisation of technology development.

In conclusion to the first three sections we are able to define our concept of innovation, which will be used throughout the study project. After the next three sections, we are able to distinguish characteristiscs in the environment as well as in companies. Brief conclusions on this can be found in the last section of this chapter.

4.2 Concept of technology

by Bertjan Davelaar

The word technology has a number of meanings, varying from 'product' to the various disciplines of science and engineering. But knowledge is always associated with technology, and advance in knowledge in a certain way is the key to economic progress. Knowledge or technology development spans several levels. Broadly, three different levels of activity can be identified which result in technological development:

1. Individuals develop ideas, theories or perspectives and acquire tacit knowledge;
2. The verfication and codafication of tacit knowledge. When knowledge is found to be valid and formalized it becomes available to a large number of people;

3. The knowledge is put to use in products, sevices or procedures.

At all three levels, development of technology is the outcome of a process of social construction because it is the outcome of activities of human beings. Four characteristics can be identified:

1. Opportunity: development takes place when an opportunity is perceived for improvement. The act of perceiving is the triggering event for technology development;
2. Appropriability: technology development because of economic motives only takes place when the fruits of the labour flow back to the developers;
3. Transferability: technology or knowledge transfer depends on human communication techniques which are not always smooth;
4. Resources: technology development consumes resources.

4.3 Concept of innovation

by Matthijs Krens

Unlike what many people think, innovation is not the same as invention. Innovation comes from the Latin word *innovare* which translates as 'to make new, to renew or to alter'. Thus innovation can also describe a new way a current technology is used or just another improvement of a current technology (for example making it smaller or faster). Furthermore innovation is not limited to new products but can also be used for new processes. Innovation can be seen as a process of problem solving consisting of four stages:

1. Problem recognition: a firm recognizes the potential of a new technology or the market need that is not yet fulfilled;
2. Technology selection: the firm researches several design concept using different technologies and decide which design has the most potential;
3. Solution development: the chosen technology is developed until a prototype or blueprint for organizational change is created;
4. Commercialization: the end product is marketed or the process implemented.

The definition of innovation can be separated into two parts. These parts are product or process development and diffusion, where product/process development is the actual development of a new technology and diffusion describes its acceptance by consumers or manufacturers. Products and processes can be technical as well as economic or political. The development of technical products is called technical innovation. The concept of technical innovation contains both

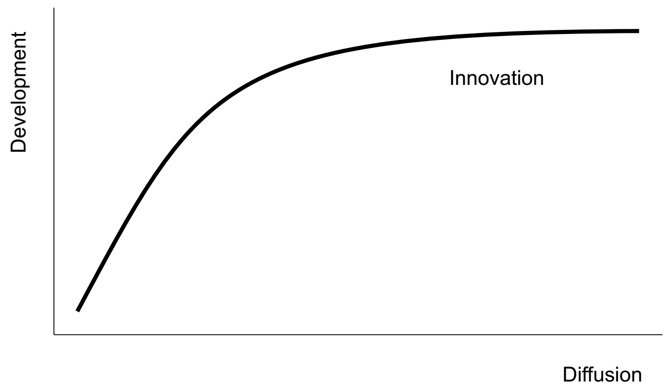


Figure 4.1: Innovation curve.

development of technical products as well as the diffusion of them. As innovation takes place it follows the line in figure 4.1.

As we can see we need both successful development and diffusion to get true innovation. Therefore we will work out development and diffusion in the following sections and we will also discuss factors that influence their speed and efficiency.

4.3.1 Development

As we said development is the creation of a new product or process. The start of development can be caused by two different reasons. When it is caused by the needs and wishes of users we call it a market pull development. These developments are often small changes creating increased functionality. When the development is caused by technological advancements it is called a technology push development.

A development can be sorted into four kinds of developments based on the amount of change in the component layout and novelty of components themselves. This is called component knowledge on which of the attributes of a process or product are changed to get the new product or process. These four classifications are incremental, architectural, modular and radical. These classifications are shown and explained in figure 4.2.

The previously mentioned market pull developments are often incremental, resulting in improved functionality (e.g. faster processors), while the technology push developments are usually radical or modular (e.g. I-mode).

Of course a technology is under development continuously. The speed at which this happens depends on the age of the technology. This process is called technology evolution. It follows a so called S-curve with development being slow at first when nobody knows how the technology should work. After this the speed of development picks up when more people start working with it and the knowl-

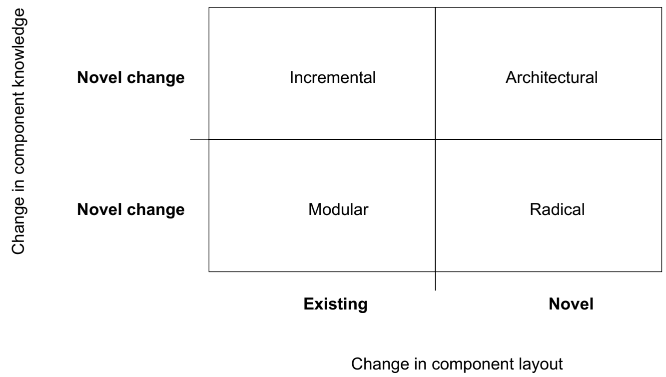


Figure 4.2: Classifications of development.

edge about the technology is at a high level. After a while the development slows down again when the technology comes nearer to its limit and improvements are increasingly hard to come by. When this is the case the need arises for a new technology so the performance and functionality can still increase. This technological progression is explained graphically in figure 4.3.

Another thing we are after in our study are the characteristics of firms that achieve innovation. From a development point of view Joseph Schumacher outlined two types of innovation: *Entrepreneurial innovation* occurs in small, flexible and proactive firms, and often have a radical development at their base. *Managed innovations* are made in larger firms often emerged from the most successful entrepreneurial firms. Managed innovations often use incremental development or process innovation. This means we cannot say if small or large firms are better at innovation. Other factors influencing the development inside a firm are:

1. Organizational structure: formalization (the amount of relevant rules and paperwork surrounding operating procedures) and centralization (where are design decisions made) are variables within the organizational structure that stifle innovation;
2. Resources: how much of its resources, both financial and labor, does a firm invest in development and research;
3. Openness to external information: this describes how easy a company accepts technologies developed by other companies and if it insists in researching everything by itself or if it accepts research results from other companies as a thing they can use as a starting point for there own research;
4. Informal communication, or the degree in which there is an open climate of communication between colleagues and employees and supervisors. A more open climate often stimulates employees to think along with the management resulting in smoother operating procedures and improved motivation for working hard.

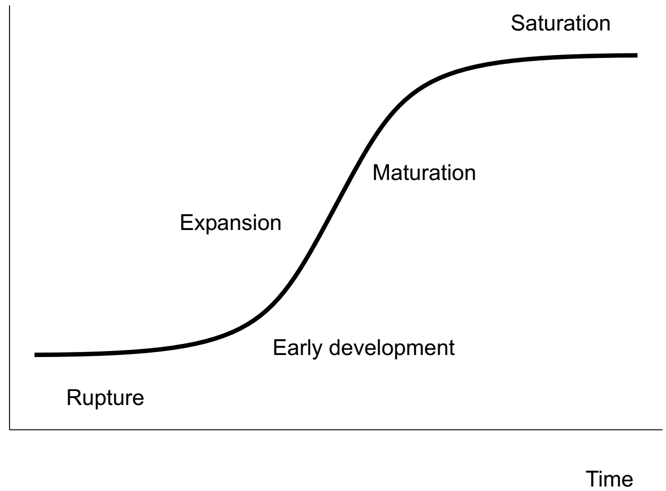


Figure 4.3: Technology progression.

4.3.2 Diffusion

When the development has taken place the created process or product still has to be adopted by consumers to make the innovation successful. The adaptation process consists of the following parts:

1. Becoming aware of the new technology;
2. Forming an opinion about it;
3. Taking the decision to use the technology;
4. Implementing or purchasing the product or process;
5. Confirming the correctness of the decision.

The diffusion of a development starts fairly slow as only a few eager consumers decide to use it. After the technology becomes better known more consumers start using it and the diffusion speeds up, and as a technical innovations becomes old the diffusion speed slows down again. So we see that diffusion also follows an S-curve. The adopting firms and consumers can be put in categories depending on where on the S curve they adopt. The innovators are the first to adopt a technology. They are very eager to try new ideas and have the financial resources to recover in case the adaptation turns out to be a mistake. The innovators are very important in the diffusion process because other companies can see how well the idea works in practical situations. The innovators are followed by the early adopters which are often the respectable citizens or firms. They are being looked up against by others and need just a little confirmation that an idea works. Then we have the early and late majority which represent the average public. The last group are the laggards. They only adopt an idea after it has proven itself and in

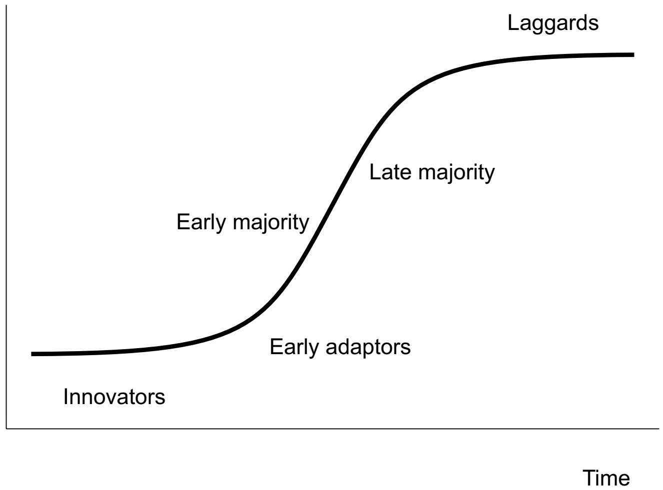


Figure 4.4: Diffusion and adoption.

this stage the innovators and early adopters have already taken to the next idea. These groups are also shown in figure 4.4.

There are two mechanisms that are the main reason for this S-curved shape. Technology substitution causes the first steps to be slow because a lot of people are reluctant to let a working idea go in favor of one that has not proved itself yet. This becomes less as others work with the new idea and the idea starts to prove itself. At the end the decline is caused by the lack of businesses that have not yet adopted the idea. The second effect is the bandwagon affect. This one explains the steep rate of adoption in the middle. The bandwagon effect describes that when a technology is used by a lot of people even more people will want to use it because it is convenient when everybody uses the same technology. This means that everybody will know something about how it works which means there is a lot of help available when a problem occurs.

Major factors that influence the speed and efficiency of diffusion are:

- Technical innovation attributes: there are 5 major attributes of a technical innovation that have an effect on diffusion:

  1. Relative advantage: how much better is it than the currently used idea;
  2. Compatibility: how well does it fit the needs and wishes of the adopters;
  3. Complexity: is it easy to use and understand;
  4. Trialabilty: can it be tested first and how much or how easy;
  5. Observability: are results from other adopters available?

- Community effects: four factors in the community influence diffusion:

1. Prior technology drag: when the prior idea is widely used, new technologies will often only be profitable on the long term;
2. Irreversibility of investments: how much does it cost to fall back on the old idea in case the old idea turns out to be better;
3. Sponsorship: this refers to an organization defining the technology and subsidizing early adopters;
4. Expectations: does the consumer expect this to be the next dominant? technology.

- Communications: this describes how well the information about a technical innovation is spread throughout the population. People will adopt earlier when knowledge about it spreads fast and easily;
- Opinion leaders: how do the trend setters react to the new technology, do famous people use the new product or do leading firms adopt a new process;
- Cultural norms: is the functionality of the new product or process in line with what people find acceptable?

4.4 Technological change

by Eelco Dalhuisen

Innovations can take on many shapes and forms, be it a new technological breakthrough, a refinement of an existing technology, or the (successful) application of a technology to create a new product. It is not uncommon for an innovation to pave the road for new research or other innovational activities. However, every chain of innovations starts with the same event: the discovery of a new technology, or, in other words, a 'disruptive innovation'. But what exactly happens after the emerge of a technology is not carved in wood. It all depends on the objectives of organizations when they decide to appropriate the technology and what to do with it.

A chain of innovation can be described according to an S-curve, where certain phases can be distinguished as shown in figure 4.5.

The discovery of a new technology can spring many of these chains. For example, the invention of magnetic data storage was the mother of the chain of magnetic tapes, but also of nowadays hard drives. But who could have known magnetic data storage turned out to be a success? The determining phases of a chain are the early development or 'emergence' phase, and later the expansion or 'incremental' phase, to be discussed in the next subsections.

4.4.1 Emergence phase or early development

The emergence phase can be seen as the design phase of the innovation chain. During this time, the new technology has to prove itself against existing, already proven technologies in the fields of costs, efficiency, potential and public demand.

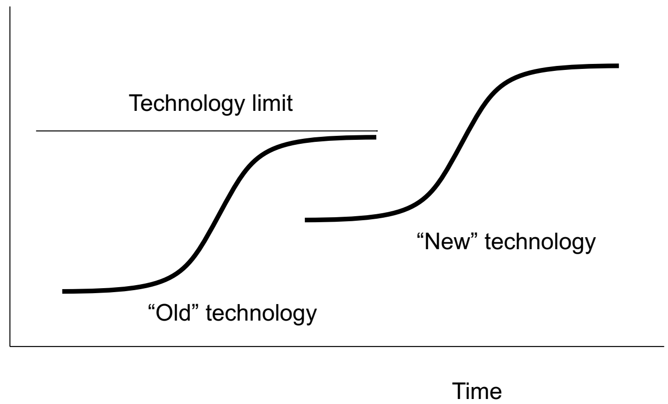


Figure 4.5: Innovation chain.

The organization has to prove itself as well; the designs it produces must be better or faster than every competitor. Determining factors in the emergence phase are:

- Technological opportunities: how much potential for innovation this branch of development has (the computer industry versus the typewriter industry);
- Appropriability: how much of the economic benefits that come from this innovation that can be appropriated by the firm (possible market share);
- Resources: how much resources can and will the firm commit to this innovation, as well as how much starting capital is needed to see results;
- Collateral assets: the requirement and availability of collateral assets (a digital satellite needs digital transmitters);
- Institutional environment: the level of rivalry found in the institutions linked to the technology (availability of suppliers, distributors, government agencies, data sources);
- Speed: the speed of changes in the competitive environment. The fastest competitor sets the pace, forcing others to speed up execution.

Eventually some will reach a design they and hopefully the consumers are happy with. By that time they can either choose to patent it, or to standardize it. Both is not without risks or advantages. Patents can yield high revenues but can also make everything useless if no one wants to use it or when others come up with a better design. Standardization has more advantages for the public as it allows for the production of standard components, reduces confusion among the consumers and gives you the home-field advantage in the next phase of development. A standardization if accepted leaves less room for deviation, restricts competitors and adds to your prestige as 'the inventor' of the product.

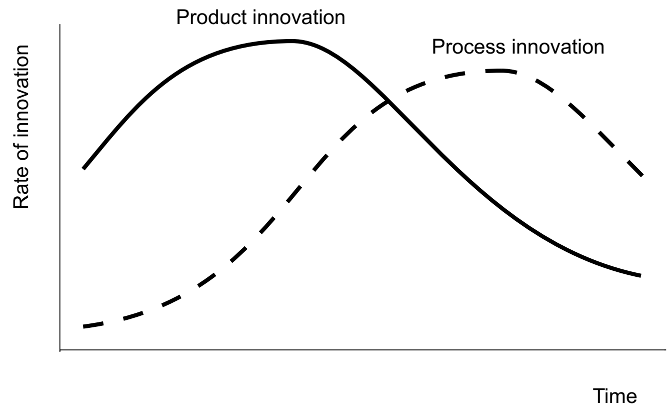


Figure 4.6: Product versus process innovation.

4.4.2 Incremental phase or expansion

When the technology has proven itself and maybe already produced a product that was marketed, the time has come to start earning back the investments. A dominant design has arisen, either patented or standardized, and now other types of improvements must find their way. Improvements can occur in several ways:

- Product innovation: improving the product, making it better;
- Process innovation: improving the production of the product;
- Architectural innovation: not altering the product itself, but improve the components it is made of;
- Stability: improve the general quality of the product.

All of these options are still considered only incremental innovations, meaning they only refine and extend an existing design, as opposed to radical innovations, which change the core design itself.

The incremental phase starts off with product innovation, but after a while the focus shifts from design to lower cost and differentiation. This is illustrated in figure 4.6.

In the end when the two rates approach each other there is a competitive equilibrium, where every still competing firm can live quietly on what they have achieved. This equilibrium can be broken by certain innovations.

First, we have radical architectural innovation: achieve the same product but with a different 'interior'. These are hard to come by because of organization and existing assets, and therefore hard to apply effectively. The impact is usually underestimated.

Secondly, there is sustained innovation: movement to the next generation of products, perhaps by an improvement in the technology which was the mother of this innovation chain, or a new standard based on the current technology. With this, firms that are lagging behind can attempt to gain ground with the leading firms and even overtake them. Also since they are still in the innovation process it is easier for them to acquire and apply the new system than those that have settled.

The incremental phase does not produce changes to the dominant design and will not provide new rival architectures. The areas of the product subject to performance improvements become articulated and will be focused on, the industry becomes well defined. Once this is reached it is difficult to enter the industry for the interested, and it will eliminate the firms that fail to make important incremental improvements. The phase ends when another disruptive innovation occurs.

4.4.3 Example: the optical disc

As an example of these phases, let's take a look at a hypothetical approach to the optical disc. The one who thought of optical storage must have been insane; we were already blessed with magnetic storage. Still, people chose to pursue the idea. After a while someone came up with the idea that an optical disc should be circular, readable by a type X laser and have a certain bit density. The first released product that emerged had a 74 minute capacity and a modest read-speed. The time for the incremental research had begun. 80 minute CDs emerged, could be read faster and even became writable. With 90 minute CDs and read speeds of 52 times the original design, the market had matured into adolescence. Until someone thought of the idea to use a different material, an X+1 type laser and multiple layers, and the process began again with the DVD. The DVD became an example of the importance of standardization; the two standards, DVD- and DVD+, slowed down development because of compatibility issues, and not to forget the consumer confusion.

4.4.4 Conclusion

It is often believed and not uncommonly true that the disruptive and radical innovations usually originate from the relatively small firms competing in the innovation chain, whereas the emergence and incremental innovations are dominated by the larger, probably international, firms. This can be because the larger firms are already well-established, are known by the public and can therefore use their position and market-share to sell their new and improved products. For a smaller firm to penetrate that market, they either have to be really good, lucky, or bring some new elements into play. The latter of those is one they can work on, and so they do.

4.5 Technological environment

by Bertjan Davelaar

Usually a number of players are involved in the development of technology. Events that take place outside the boundaries of a firm often determine the course of development undertaken by the firm, besides the profit potential. To manage its technology development effectively, a firm will have to pay attention to developments outside its boundaries, like policies of governments, actions of competitors and other developers of technology. This is the environment a firm operates in.

Environments in general and the technological environment specifically are described in the first subsection. Then, actors in the technological environment and interlinks between them are discussed. The following subsection deals with the dynamics of the technological environment. Next, as an example of these dynamics, three current trends in technological environment are discussed. Tthis section is ended with a conclusion.

4.5.1 Environment and technological environment

In open systems, as companies can be considered, internal management actions are designed on basis of the environment. The central problem of management is viewed as orchestraing organizational activities to meet the challenges of the environment, so understanding the technological environment is critical for succesful management of technology. Besides technological environment, there are other sorts of environments confronting an organization.

Levels of environment

In theory, everything outside a firm is environment. Because this is not useful for understanding critical environmental influences, a firm will be visualized as being enclosed in three levels of environment.

Task envrionment or micro-environment

Much of the daily activities of a firm deal with its task environment because it refers to the set of customers, suppliers, competitors and other environmental agencies.

Industrial/competitive environment or meso-environment

This environment is comprised of a firm and its competitors and factors that directly affect all competitors, although the effect can differ by firm. Factors of influence are for example new entrants, substitute products, customers and rivalry.

General or macro-environment

This environment affects almost all industries, containing four major segments; social (demographics, lifestyles, social values), economic (stock, resources consumption), political (electoral processes, judicial institutions) and technological (technological progress like new products, processes and level of scientific activity).

The various segments are interlinked and because they are related, developments taking place in one sector influence developments in other sectors. Furthermore, the various segments can differ from one nation to another. It should be noticed that for the economic and technologic sectors, there is much more interdepence among nations then the social (population growth for example) or political (structure) sector.

Technological environment

Technological environment is a major segment of the macro-environment and it is linked with other segments. For three reasons it is the most visible and pervasive segment in a society. It brings new products, processes and materials, it directly impacts every aspect of society and it alters the rules of global trade and competition. The segment is composed of institutions responsible for creation of new knowledge and the application of that knowledge to develop new products etcetera.

Creation of new knowledge

The knowledge base of technology is usually derived from basic research, defined as original investigations of advancement of scientific knowledge that do not have specific objectives or do not bind this knowledge to practical problems. Discoveries in science provide opportunities for technological invention.

Application of knowledge

With scientific knowledge it is tried to design or to solve practical problems in an innovation. Here, scientists and engineers work together. The application of knowledge consists of activities like applied research, development, engineering and commercialization. These activities often overlap in the process and each activity requires a different level of technological skill and business orientation.

4.5.2 Actors

Types of actors

In the technological environment innumerable organisations are directly or indirectly engaged in developing technology. Four types of actors can be distinguished, private versus public and developers versus facilitators.

Besides profit-making enterprises many non-profit organizations carry on the task of developing technology. The difference is mainly the degree of transparency where public agencies have a higher transparency and accessibility then private enterprises.

The technological environment consists of organizations actually engaged in the task of developing technology and organizations that facilitate by providing information, access and resources.

Public technology developers engage merely in basic research. Private developers play a leading role in applied research, development, engineering and commercialization. Corporations play several roles that lie in the core of management of technology. They are drivers of change by creating new product and processes. They are beneficiaries of technology change initiated by others but can also be victims of technology change initiated by others. New products and processes can improve their value but also that of competitors. Companies can facilitate technology development by others through investments. Corporations both shape and are shaped by technological changes.

Innovation networks

In the technological environment many interlinks between the actors develop. These networks facilitate the flow of information, resources, personnel and other inputs necessary for technology development and diffusion. It is important to understand the connections to grasp the dynamics of the technological environment.

Increasingly connections are formed among the private and public technology developers, often because a project cannot be performed solely by the skills or resources available to a single firm.

Public or private facilitators stimulate development by other organizations, creating interorganizational linkages. There are three major capacities. They can be resource providers to stimulate development in a certain direction. Policy analists can channel the direction of development through persuasive argumentation. Linking organizations often link technology developers, resource providers and entrepreneurs.

The relationships often culminate in the formation of innovation networks or clusters. These clusters are not confined to high-technology industries, but exist also in traditional industries. Innovation networks are a major feature of developed economies.

Networks form when the benefits of proximity to competitors outweigh the costs. These networks speed up technology development for several reasons. They assist in the diffusion of technology, create a critical mass of skills that speed up knowledge development and provide a social safety net for individuals. Victims of risky innovation often can seek employment in an existing labour market.

Especially personal linkages are important. Information on choices of competitors, flow of funds into new technology thrusts, or availability of expertise is only available through these linkages. This kind of information is critical in understanding the technological environment, making technology-related decisions and managing their implementation.

Cross-national differences among networks

Some nations have begun to recognize that national competitiveness requires a national innovation system that speeds the transfer of basic research results to applications, marketable products and processes. At the same time some nations have initiated networks that ensure that technology is made available to all industrial segments. Especially to the small and medium-sized enterprises because they are an important component of national economy but don't have the internal resources necessary to fund any appreciable research and development projects. The degree of formalization of these networks differs from country to country.

4.5.3 Changes

The technological environment is dynamic and evolves over time. Changes in the technological environment often come about in two interrelated ways; induced changes and autonomous changes.

Induced changes

Forces in other macro-environmental segments than the technological segment trigger changes in the technological environment. Induced changes represent the technological consequences created by social, political or economic forces. Of particular importance for the technological environment are the political (or regulatory) and economic segments.

Within any nation, the political environment shapes the scope and directions of basic research and the thrust of more applied technological developments. It's an ongoing debate about the role the government should have in technology development. Some argue that the government should let free markets drive the direction of technology development. Because the government can facilitate and develop technology, there are at least three ways it can influence the technological environment. It influences the thrust of major basic research, through regulations it can facilitate or impede every phase of development and it can act as a facilitator of private sector technology development.

Economic conditions exert a primary causal influence on the level and pace of technological change. Corporations often turn to technology to address the challenges created by economic pressures by adopting more efficient technology. It is often suggested that basic and applied research are driven more by the prevailing market or economic conditions than by the availability of scientific and technological knowledge.

Autonomous changes

Changes that are initiated by technology developers but largely independent of the forces in other macro-environmental segments are called autonomous changes. These changes are less predictable than induced changes but can be tracked on an ongoing basis through personal source information. Whereas other macro-environmental segments cause induced changes, autonomous changes in technology are drivers of fundamental social and economic change.

When the development of society is traced along three stages, the changes are caused by a turbulent changing technological environment. The first stage is agriculture, the second machine production and the third stage refers to the information revolution. Each stage represents a radical different social segment.

A group of economists argue that technological innovation lies at the heart of major period of economic expansion in a long-wave theory. First discoveries in science trigger technological innovation, leading to new products and markets. Second, new industries are formed around these markets. Third, as technology matures, many competitors enter internationally, eventually creating excess capacity that in turn decreases profitability. Finally, business failures, unemployment, and attendant economic turmoil in financial markets may lead to depressions.

Induced and autonomous changes create opportunities and threats for firms. Induced changes can be predicted, autonomous changes hardly. Firms will have to track these changes on an ongoing basis. The information lies with individuals in various organizations.

4.5.4 Trends

In the twenty-first century, technological change is accelerating and becoming increasingly pervasive. Three general trends deserve special attention; globalization, time compression and technology integration.

Globalization

The process, by which the various nations in the world are increasingly being connected politically and economically throug international trade, is called globalization. Four aspects of globalization have signifciant consequences for the technological environment: the resources allocated to technology development, the location of manufacturing facilities, the role of multinational corporations and the differing comparative advantages of nations in techhnology development.

Resources allocated to technology development

The proportion of resources spent on technology development is different among countries. Some increase more then others, but globally total R&D expenditures are increased. Because R&D expenditures represent inputs to technology development, it could be expected that the outputs of technology development efforts correspond to the trend in R&D expenditures. This is confirmed by the increased patent output. These trends have two implications for the technological environment. Because more countries participate and more money is spent on R&D, the rate of change in the environment can be expected to increase. Secondly, the scope of the technological environment has broadened beyond the borders of traditional strongholds of science and technology (the US and Europe). Over the entire world, like in China and Korea, technology development is conducted.

Location of manufacturing facilities

Until the 1970s most manufacturing facilities were located in the nation of origin of a firm. But the trend since the 1970s is to move manufacturing facilities to underdeveloped countries in the world. As a result, improvements in production also occur in other places then advanced industrialized countries.

Rise of multinationals

A characteristic of globalization is the rise of multinationals and in the twenty-first century, multinationals from countries other then then the US, are becoming more and more important. Also the R&D that's done outside the host-country increases. So nowadays, technological development should be tracked on a global basis.

Comparative advantage of nations

Economists have long recognized that different countries have different comparative strengths. As globalization has proceeded, both multinational firms and firms following global strategies have begun to take account of the comparative advantage of various countries. Comparative advantages are for example factor costs or the ability of nations to create specialized technology-based assets and these factors can encourage firms to locate activities around the globe.

Time compression

A second major development in the technological environment is time compression, which refers to the rapid decrease in time between criticial events in technology development and commercialization. An important technological strength of a nation is its ability to learn, adapt and innovate at a faster rate, so developments are faster translated to products and processes. There are three facets of time compression discussed here: shortened product life cycles, shortened development times and increased pressure exerted by decreasing payback periods.

Shortened product life cycles

Product life cycles refer to the evolution of sales of a product over time, from its introduction to the time when its market reaches maturity. These life cycles are shortened.

Shortened development times

The time it takes to develop a specific technology into a marketable product also decreases. If this time reduces, companies often can reduce development costs substantially as well. They are not only faster but also more efficient in development. Both the time reduction and the cost reduction vary from country to country and from industry to industry.

Decreasing payback period

A third factor that is driving time compression is the pressure exerted by capital markets to yield reasonably quick returns on investments in technology development. Insitutional investors own increasingly more shares of publicly traded companies. The portfolios of these institutional agents are highly diverse and they tend to base their investments on limited information, as current earnings or patent approvals. These measures encourage firms to undertake forms of investment for which returns are most readily available.

The worldwide systems are somewhat different but the national systems are converging, partly as a result of globalization. A consequence of the demanded reduced payback periods is to speed up time compression both in product life cycles as well as in the development times. Firms often can't reach these targets themselves but have to collaborate with others, or they need to imitate or borrow technologies from other firms. This results in stronger interconnections among the various organizations.

Technology integration

Every product that appears on the market is composed of a number of distinct and identifiable technologies. Although innovation can take place through development of very specific technologies, technology integration refers to the idea of technology development through the combination or reconfiguration of existing technologies. In recent years, there has been growing awareness of the potential inherent in technology integration. By combining core technologies, a large number of applications can emerge. This integration can take place by combining technologies to develop new products and by combining technologies to commercialize a product.

Combining technologies to develop new products

Technology development often requires the ability to develop or access different technologies and synthesize them into a product. Firms occasionally specialize either in a single core technology or in technology integration. Some firms are able to develop technology along both these lines.

Integration of technologies for commercializing products

To successfully commercialize a product, a firm has to utilize its product know-how along with such process technologies as manufacturing, marketing and after-sales support. Technology integration is almost a prerequisite for commercialization. The economic potential inherent in technology integrations has two major implications for ongoing organizations.

- To fully realize the potential of technology integration, organizations should not only farm technologies, but also gather technologies from outside;
- The potential for technology integration suggests that the main actors in the technological environment will be increasingly interconnected. Such interconnections will help the transfer of technology such that the full potential of technology integration can be realized.

4.5.5 Conclusion: managerial implications

In conclusion to this subsection, three significant managerial implications flow from our discussion of the technological environment:

- Technological environment is dynamic and needs to be tracked on an ongoing basis. From an open-systems perspective, management of organizations, including technology, should be predicated on the environment facing organizations;
- Tracking technological changes in the environment requires managers to penetrate the organizations and networks that conduct and facilitate technology development;
- The three trends - globalization, time compression and technology integration - require managers to adopt a global perspective, enhance organizational speed of response and work with other organizations to adapt to technological changes as well as to fully exploit the potential of new technology.

4.6 Technology strategy

by Kasper van Zon and Mathijs Marsman

Technology strategy is one of the most important factors of the competitiveness of a company. A company with a good technology strategy can compete better.

The question here is: how can a good technology strategy be constituted and executed? To answer this question we first emphasize the role of environmental intelligence in the formulation of strategy. Then we will explain how a technology strategy can be made. We will end this section with an explaination of how a technology strategy can be executed.

4.6.1 Determining the environment

To examine the role of the environment on technology strategy, we first explain technology intelligence. After that the process of mapping the technology environment is explained.

Technology intelligence

Technology intelligence contains all technology-related information used by a company. This information is interpreted by a company to descript current and potential technology-related changes. Technology intelligence has three levels:

- Macro level: general technology trends. Macro level technology intelligence is useful to determine long-rated focus on national and corporate levels;
- Business level: specific technology and general trends. Business level technology intelligence is useful to determine medium-rated focus on business level;
- Program or project level: specific technology and specific trends. Program or project level technology intelligence is useful to determine short-rated focus on product and process level.

Mapping technology environment

Mapping technology environment is the process of gathering and analyzing external data to derive technology intelligence. The process of mapping the technology environment has four steps:

1. Scanning the environment to detect ongoing and emerging change. Data sources to scan the environment can be: personal networks, trade shows, consultants, patent statistics, literature research, internet, etcetera;
2. Monitoring specific environmental trends and patterns to determine their evolution. Monitoring has the intent to find certain patterns in the environment. Therefore monitoring is more focussed and more systematic than scanning;
3. Forecasting the future direction of environmental changes. The data from the scanning and monitoring step can be used to forecast the future;
4. Assessing the current and future environmental changes for technology strategy.

4.6.2 Building a technology strategy

When the environment is described the technology strategy can be made. First it is explained what technology strategy is. After that the process of making technology strategy is described.

Technology strategy is the revealed pattern in the technology choices of firms. These technology choices are made in three domains:

- Technology appropriation, or commitments to build technological capabilities;
- Deployment in products, or commitments to exploit technological capabilities through new product development;
- Deployment in value chains, or commitments to exploit technological capabilities in operations.

The technology choices of a company can secure competitive advantage by creating fundamentally new business, by altering the rules of rivalry in existing competitive domains and by supporting existing businesses.

The process to make technology strategy has four steps:

1. First the fundamental objective of any company is the creation of value for its customers and its investors. The objective is to create competitive advantage;
2. Second step is drivers. What are the possibilities in the environment? Is the company well positioned to use these possibilities? The answers on these questions give a company an idea of its strengths and weaknesses;
3. Third step are the decision criteria. The choices are limited by resources (capital, time, etcetera);
4. Fourth are the choices. The company makes choice based on the previous steps. These choices are the technology strategy of a company.

The technology strategy of a company can be divided into different categories, depending on specialisation in one or many technologies and introducing new technologies or adopting technology from competitors. These categories are schematically represented in figure 4.7.

4.6.3 Executing technology strategy

The technology strategy has to be executed. Therefore choices on the appropriation of technology, the deployment in new products and the deployment of technology in the value chain have to be made. In the next three sections we explain these three domains of choices.

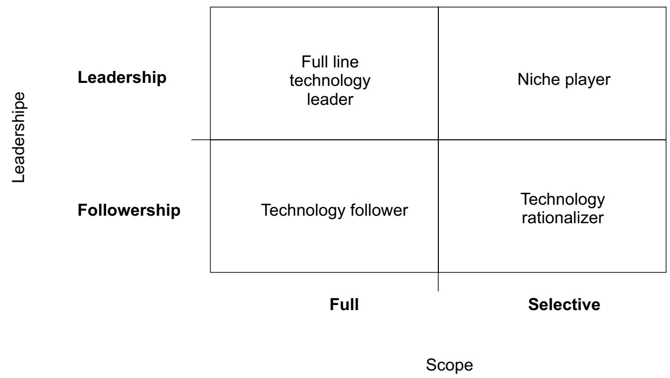


Figure 4.7: Technology strategy types.

Appropriation of technology

Appropriation of technology refers to obtaining technology by a firm. This can be done either from in-house R&D, which is mostly the main source of technology, or from external sources such as strategic alliances. The decision to appropriate different technologies may be driven by technology push or market pull considerations.

Since the 1930s the industrial R&D has evolved. Therefore the practise of technology appropriation has been classified into three generations.

1. In the first generation, the future technology of a company is mostly decided by the R&D function alone. This generation is characterised by the lack of a strategic framework for the management of technology;
2. The second generation is a transition state between the first and the third generation. The communications between business and technology management are getting better and there is a strategic framework for managing technology at the project level;
3. In the third generation there exists a strategic and operational partnership between technology managers and the rest of the organization.

If a company wants to appropriate a new technology it has to choose between external sourcing or in-house development. The decision depends mainly on the competitive position of the firm in the specific technology and the importance of the technology to the firm. Based on these two factors, technologies can be classified into four groups. The first group contains the *Internal R&D*: these are the technologies in which the firm has a strong competitive position and that should be nourished in-house since they are important to the strategic direction of the firm. The second group of technologies are the *Candidates for external acquisition*. External acquisition of a technology should be applied when the strategic importance is high, but beyond the capabilities of the firm. The third group contains the *Candidates of disinvestment*. These are technologies that are within the capability of the firm but have low strategic importance. These technologies may be licensed to specialist firms. The fourth group are the technologies with *Limited investment*. The firm is less experienced in these technologies and they are of no strategic importance.

External sources of technology can be government laboratories, universities and other companies. If a company decides to use external sourcing challenges like intellectual property, secrecy and procedural details should be addressed.

Deployment in new products

When a firm has obtained a new technology, it has to be applied in one or more products. Firms usually classify their products into five categories: products that are new to the world, products in a new market segment, products that are line extensions of the firm's current market, products that are improvements of existing products and products that get a new user application. Companies infuse technology to the market either by bundling or disruptive technologies. In bundling, companies are combining separate elements of their product lines in a bundle. They offer their products to the market in a package. Bundling offers three opportunities for a firm in its product development activities: cost reduction, market expansion and product enhancement.

When companies develop a new product, there are three interrelated strategic factors that they consider:

1. The strategic context: when a firm decides to introduce a new product it has to consider what its business strategy is, what the risk-return trade-offs are and if it has enough resources;
2. The leadership of the technology: a company has to decide whether it wants to position itself as a technology leader or a technology follower. The choice of this should be based on the sustainability of the technological lead, the first mover advantages and the first mover disadvantages;
3. Timing of product launch: a firm has to weigh the risk of premature entry against the problems of missed opportunity.

Deployment of technology in the value chain

The choice of which technologies to deploy in the value chain depends on environmental and firm-related factors, both market and technology related. The environmental factors are the industry and technology factors. The technology context determines the availability of the technologies that are appropriate for a firm to deploy in its value chain. The competitive domains determine where in the value chain the firm should deploy its technologies so as to support its corporate strategy. The business strategy of the firm determines whether it should adopt a specific technology or not. A firm strategy could be to have low cost or differentiation. This can be achieved by setting objectives as efficiency, quality, innovation or customer responsiveness.

The decision to deploy a specific technology in the value chain is driven by four major criteria:

1. To what extent can the objectives be accomplished;
2. Are there enough resources available to deploy the technology;
3. Do the benefits outweigh the costs;
4. Can the deployment be implemented fast enough?

The process of deciding to deploy technologies in value chains involves four steps: making up a diagnosis, alternatives, the evaluation of the alternatives including the choice of one alternative, and the implementation. In the diagnosis the competitive domains, the firm's strategy and the objectives of the deployment are examined. In the evaluation, the alternatives are subjected to the four decision criteria mentioned above. The implementation of the deployment involves changes in organizational structures and routines. These changes are critical to the success of the deployment. Companies should really be cautious in this phase. The implementation process has three important characteristics:

1. Reinvention: this is the reconfiguration that has to be made in the value chain while a company is deploying a new technology. The approach to value chain reconfiguration needs to be customized to the particular circumstances facing a firm;
2. Mutual adaptation: this should happen simultaneously with reinvention and it is adaptation of the organization to use the new technology;
3. J-curve of implementation: during the early phases of implementation the benefits of change are not directly visible. The J-curve states: things get worse before they get better.

4.7 Organization of technology development

by Michel Franken and Bertjan Davelaar

In the past, many firms had people that worked in the function of Chief Scientist. Besides prejudgements, it created certainly one clear disadvantage because in some way there was a boundary between technology and the end result of a company. There has been a shift which transformed the function of Chief Scientist into the Chief Technology Officer (CTO). The CTO's job continues till the moment a product is put into service and works smoothly. Technology has been in the forefront of change in the past decades and many new products and processes found their way to daily life. Furthermore, technology has contributed strongly to productivity enhancement. In the 1950s was already concluded that 87.5 percent of increased capital was due to technical change. Technology can be assigned a certain value in a company, just like all other parts. The task of the CTO is to manage technology in such a way that the costs of technological change are acceptable in relation to the revenue potential.

It is important to manage innovation in a good and organized manner. This is important since wrong decisions can lead to lacking results, due to the inability to exploit the creative powers of the personnel, or due to unnecessary high expenses. Prior to choosing this management structure the company first has to formulate a technology strategy.

In this section, we first look at two different views on business objectives and to different key concepts of firm strategies. Then we look at different views on the management of technology. This section ends with organization forms of management of technology development.

4.7.1 Business perspectives

Management of technology focuses on the principle of strategy and organisation involved in technology choices, guided by the purpose of creating value for investors. To approach management, something about a firm's identity and goal has to be clear. The business of firms can be globally divided into two main perspectives: market based and resource based views.

Market based views

Traditionally, the markets they serve define business firms. This market based perspective prescribes that firms should define their markets broadly rather than narrowly. But broadening the target market is of little value if the company cannot easily develop the capabilities required for serving customer requirements on a broad basis. Market based perspectives tends to underplay the role of internal capabilities of the firm.

Resource based views

In recent years, resource based views of the firm have developed as a complementary perspective to market based approaches. In general, the greater the rate of change in a firm's external environment, the more likely internal resources and capabilities will provide a particular foundation for long-term decision making.

For our purpose, the management of technology embraces both perspectives; resource based and market based. Both the development of technological capabilities and their deployment in products and processes constitute the central functions of technology management.

4.7.2 Key concepts of firm strategy

Firms can be seen as a set of interrelated activities that interfaces at multiple fronts with its environment. Each activity should contribute something to the whole function of the firm, and the effectiveness of a firm depends on how successful a firm interfaces with the environment. To develop ideas about the management of technology in this view, four major concepts will be deployed.

The firm as a value chain

Every firm is a collection of activities that can be represented by using a value chain. Broadly, value chains consist of primary (logistics, operations, marketing and service) and secondary (procurement, technology development, human resources and infrastructure) activities. A firm delivers value to his customers relative to the price paid for the product and the superiority of the product. The value appropriated by the firm depends on the value created by the customers in relation to the firm's cost structure. The value chain is a mechanism to capture the cost structure of a firm and is the basis on which to judge whether the firm creates value for investors.

Industries as competitive domains

In this view, an industry represents a group of firms that offer similar products or services to customers and forms a competitive domain. One classification system distinguishes industries by grouping key competitive resources into three categories; capacity (like food processing, basic resources), customers (like food products) and knowledge (like electrical of scientific equipment).

Process or product technology

Technological change can be divided into two types; process and product technology. Process technology pertains to the techniques of producing and marketing goods and services, including the work methods, equipment, distribution and logistics. Technology changes are designed to produce faster, more efficient or in greater volume. Product technology refers to the elements of technology embodied in goods and services of a firm. These changes range from minor refinements to entirely new products.

Process technology refers to the way an organisation conducts its business, whereas product technology refers to the output of an organisation. Keep in mind that the process of one firm can be the product of an other firm. There are three reasons to make the distinction between product and process technology:

- Process technology changes are much less visible in the marketplace;
- Both process and product technology changes have ramifications for the economic performance of the firm. Process technology often reduces costs

or cycle time for a firm's product;

- Process technology changes modify the way a firm conducts its business, product technology helps firms compete for customers.

Competitive advantage

Competitive advantage is the ability of the firm to outperform rivals on profitability and depends on how a firm is able to create value for its customers that exceeds the firm's cost of creating the product. Competitive advantage is considered as the major objective behind management of technology decisions.

4.7.3 Technology development structures

The organization structure defines how innovative tasks are distributed and carried out. Because innovation differs in nature from the normal operations of the company, the organizational arrangements used by companies to organize and execute those innovative tasks also differ from those that are used to execute the normal operations. There are three types of organizational mechanisms that are used by companies to organize their innovative tasks: the set-up of separate units for innovative activity, the creation of a new project group, or the start of a new venture division. These will be discussed in the next paragraphs.

Separate units for innovative activity

By allocating innovative tasks to separate units within the company, it signals that it is committed to building technological capability in pursuit of competitive advantage. These units enable the company to:

1. Conduct focused near basic and applied research that is strategically aligned with the firm's efforts;
2. Conduct higher and long lead-time research projects that are essential to a firm's strategic objectives;
3. Establish a means to gather, synthesize, and transfer scientific and technical information from the scientific community;
4. Create radically new process and product technologies that could be developed into new products and services;
5. Act as a window on science and technology developments that could pose a threat or opportunity for the firm.

In medium sized companies the set-up of a separate unit for innovation activity is preferred to stimulate innovation, but in general it demands a long time commitment of money and resources from the company to sustain these units. Therefore the establishment of a unit should be based on a sound economic reasoning. Main reasons for companies to establish these corporate research centers are:

- When firms seek leadership in product introduction and they seek to use technical excellence as a basis for building competitive advantage;
- When competitors have established their own corporate laboratories, thus signaling an era of technological change in the industry;
- For conducting long-term product and process development, especially when various divisions are focused on shorter medium-term results;
- When there are economies of scale in consolidated research, whereby the various divisions share the common technologies.

Project based organization

This mechanism for the organization of innovation is mostly used when innovation is focused on the creation of new products or the implementation of new technologies. Projects are carried out in teams consisting of personnel from various disciplines. Because it is important to keep their creativity focused on the business goal of the projects, project managers should both provide technical and managerial guidance.

There are two main forms of permanent project organizations in use by firms. The first one is the so-called matrix organization. Here, employees have two supervisors: a functional chief and a project leader. Both supervisors have their traditional rights as supervisors, but they do not need to have both a technical and organizational talent. The second form of permanent project organization is the so-called quasi structure. In this structure there is a formal and quasi-formal structure. The formal structure is actively used to guide the employees in firms, for drawing out their responsibilities, for defining the connections between positions, and in general, to ensure attention is paid to the appropriate tasks. This formal structure is continually redefined as a result of frequent product and manufacturing process changes. The quasi-formal structure consists of the extensive use of committees, task forces, teams and dotted-line relationships to resolve problems that arise due to these changes. This quasi-formal structure is relevance-based and problem-focused and transcends the formal structural boundaries that might otherwise impede problem solving.

New venture divisions (NVD)

Radically new products are often allocated in an NVD to decouple their development from the established structures in the company. This provides an environment in which new business opportunities can be explored, turned into projects and provided with the opportunity to demonstrate economic viability. After that has been shown, they can be more readily integrated into existing divisions or be established as new operating divisions of a firm.

The choice for one of the three organizational mechanisms mentioned above is influenced by four major factors besides the technology strategy. The demands arising from these factors are sometimes contradicting, so the real choice will always be a trade-off and are therefore unique for each company. The four major factors are:

1. The environment: what is more dominant, the available market or the available technology;
2. The strategic context: what is the context of innovation in the corporate strategy;
3. Economic considerations: should the innovative tasks be centralized or decentralized;
4. Desire to globalization: what are the opportunities abroad?

Whatever organizational structure is chosen, the innovative tasks will still have to be done be people. And therefore they play an important role in the ability of companies to innovate and sustain those innovative activities. The ensemble of personnel in companies that are able to sustain continuously innovation share several cultural traits:

- The enthusiasm for knowledge: respect and encouragement for the accumulation of knowledge;
- The drive to stay ahead in knowledge: staying knowledgeable about the latest developments in technology;
- The coupling of complimentary skill sets: clear and tight linkages and good communications within the company;
- The alteration in activities: continuous reexamination of activities to try to improve those activities;
- Higher order teaming: self-examination by the personnel.

Now that the organizational structures have been examined, the role of general management in the innovative process can be discussed. Besides the implementation of a good organizational structure, general management has four additional tasks that are important for innovative activities. These tasks are:

- Definition of purpose: general management has to lay out the course to achieve its objectives;
- Choice of leadership: the management has to appoint the right people to crucial, leadership, functions;
- Managing transitions: the chosen organizational mechanism is likely to change over time, so general management will have to manage the transition between one mix of organizational forms to another;
- Resource allocation: the management has to ensure that sufficient resources flow to the organizational mechanisms.

4.8 Conclusion

In this chapter answers to the following research question can be found:

> *What definition of technical innovation and its characteristics are appropriate for our research?*

First, the concepts of technology, innovation and technological development were highlighted. Second, the technological environment has been discussed. Third, technology strategies have been presented and finally, the organization of technology has been discussed.

Innovation comprises both product development and diffusion of both products and processes. The definition of 'innovation' that is appropriate to our research contains both development and diffusion, but is limited to products and processes as far as they involve technological advancements. Therefore we prefer to speak of 'technical innovation'.

Innovation goes hand-in hand with technology development. Culture has a big influence on innovation since technology development is the outcome of a process of social construction. Main factors here are the enthusiasm to grasp opportunities, the level of appropriation of technology developments and the quality of communication lines between persons over which technology is transferred.

The technology environment is a main input factor for institutions to determine their technology strategy and organization. In this report, we present only our conclusions on factors that influence innovation within the macro- and meso-economic environment. The micro-level environment is investigated in the sequel of this research project.

Interaction with the macro-environment takes place along two directions. To understand this we need to know that the dynamics of the technological environment is caused by both induced changes and autonomous changes. Political, economic and social factors initiate induced changes, whereas autonomous changes are initiated by technology developers and drive fundamental social and economic changes.

At the meso-economic level, institutions can be classified along two dimensions: private versus public organizations and organizations that develop versus organizations that facilitate. Also profit- and non-profit organizations exist. Between these actors innovation networks exist which are important for understanding the dynamics of the technological environment. They facilitate the flow of information, resources, personnel and other inputs necessary for technology development and diffusion. Especially personal linkages are important.

Chapter 5

Macro research results

Chapter contents

5.1 Introduction

by Bart Spikker

This chapter gives the results of the macro research done for the countries Japan and the Netherlands. Also the main research question will be answered by means of several research subquestions. The whole macro research is split into several parts.

The macro level considers the environment around the meso and micro environment. The main research question is:

> *What are important forces in society that support or inhibit innovation on the national and international level?*

A scan of the external macro-environment in which the firm operates can be expressed in terms of the following factors: Political, Economic, Social and Technological. The acronym PEST (or sometimes rearranged as "STEP") is used to describe a framework for the analysis of these macro-environmental factors. Beside these, also a review is done on the geographic and historical factors. This way we get a better view on the country as a whole.

For the political and economic factors a distinction between an international context and a national context is made. The international context describes the factors for the country with respect to the rest of the world, while the national context describes the factors within the borders of the country.

Hereunder a short description of every factor will be given. The research questions belonging to these factors are given as well.

Social factors

An obvious difference between Japan and the Netherlands is culture. For instance, the working culture in the countries is very different. Thus the technology products are invented and built in a different way. This is a very obvious example of how the culture influences innovation of technology products. Therefore the research question is:

> *How do (socio-)culture differences between Japan and the Netherlands influence innovation?*

Social factors include the demographic and cultural aspects of the external macro-environment. These factors affect customer needs and the size of potential markets. Some social factors include:

- Health consciousness;

- Population growth rate;
- Age distribution;
- Career attitudes;
- Management culture.

Technological factors

When we say 'innovation', people almost immediately think of research, development and high-tech products. When we say 'Japan' most people have a picture of small people copying western technology products and sell it for a low price. This is only one example of a difference between technology in both countries. More general, the question becomes:

> *What are the differences between the Japanese and Dutch technology industry and what does this mean regarding innovation?*

Technological factors can reduce minimum efficient production levels and influence outsourcing decisions. Some technological factors include:

- R&D activity;
- Automation;
- Competitive advantages of Japanese companies in the world market;
- Competitiveness;
- Rate of technological change;

Geographic factors

Looking at both countries one sees a lot of differences in the landscape. Of course this will lead to a different development of for example the infrastructure. Also the position of the country with respect to other countries is important. So a lot of geographic factors play a role in the question:

> *What geographical factors support or inhibit innovation on the national level?*

Geographical factors will always influence a country's innovation, mainly because these factors will not change in time. Some geographical factors include:

- Slope of landscape;
- Climate;
- Natural threats;
- Natural resources.

Historical factors

The history of a country can have a big influence on e.g. the civilization and therefore the innovation level. Therefore we put the question:

> *What differences in history are important factors that support or inhibit innovation?*

Some important historical factors include:

- Rulers and ruling-system;
- Wars;
- Bondage with other countries;
- Influence of religions.

Political factors

A government has the desire to have their country belonging to the best innovating countries. Here, we also wonder why. To be more specific:

> *What are important political forces on the national level regarding innovation?*
>
> *What are important political forces on the international level regarding innovation?*

Political factors include government regulations and legal issues and define both formal and informal rules under which the firm must operate. Some examples include:

- Tax policy;
- Employment laws;
- Environmental regulations;
- Trade restrictions and tariffs;
- Political stability.

Economic factors

Economic factors affect the purchasing power of potential customers and the firm's cost of capital. The research questions become:

What are important economic forces on the national level regarding innovation?

What are important economic forces on the international level regarding innovation?

The following are examples of factors in the macro-economy:

- Economic growth;
- Interest rates;
- Exchange rates;
- Inflation rate.

This chapter is mainly built up in sections, in which the research subquestions are discussed. There is also a general economic section which treats (the history of) the economy in Japan and the Netherlands. In the last section the conclusion is discussed which also gives an answer to the main research question.

5.2 Geography

by Joost de Klepper, Janarthanan Sundaram and Mathijs Marsman

In this section the geography of Japan is discussed to find an answer on the question:

What geographical factors support or inhibit innovation on the national level?

The first subsection gives an overview of some geographical facts and descriptions about Japan. The second subsection discusses how these factors have their influence on innovation in Japan. In the third subsection similarities and differences in this area between Japan and the Netherlands are discussed. The section is ended with a conclusion.

5.2.1 Overview

Japan

Japan consists of several thousands of islands forming an arc in the Pacific Ocean. The four largest islands are (in decreasing order of size): Honshu, Hokkaido, Kyushu and Shikoku. The Pacific Ocean lies in the east while the Sea of Japan and the East China Sea separate Japan from the Asian continent. The sea crossings between Korea and Siberia are relatively small, and therefore have played an important role in the Japanese history. The total size of the country is 377,835 square kilometres. This is comparable to Italy or about nine times as big as the Netherlands. The northernmost islands are located approximately on the same latitude as Milan and Bordeaux while the southernmost islands are on the same latitude as the Canary Islands.

Because the sea between Korea and Japan is relatively narrow, it has always been very important to Japan. It was this strait that the first inhabitants of Asia crossed to come to Japan. Because Japan could only be reached from Korea and Siberia, the Japanese inherited most of their culture and habits from the Koreans and the Chinese. Japan still profits from its location near Korea and China. In the first place because the labour costs in these countries are much lower, but more recently these countries also show to be very capable competitors for Japan.

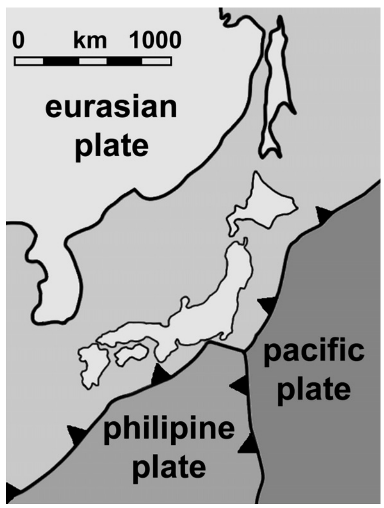


Figure 5.1: Continental plates.

Japan lies on the junction of three continental plates: the Eurasian Plate, the Philipine Plate and the Pacific Plate. These continental plates are in a continuous movement, causing great stresses in the earths crust. Due to this fact Japan suffers from many earthquakes. Around 1,500 earthquakes are recorded yearly, and magnitudes of four to six on the Richter scale are not uncommon. Minor tremors occur almost daily in one part of the country or another, causing slight shaking of buildings. Major earthquakes occur infrequently, but can disable large cities and kill many people. Undersea earthquakes also expose the Japanese coastline to danger from tsunami, tidal waves.

Another result of the shifting continental plates and the subduction of the Pacific Plate under the continental plates is that there are many active and inactive volcanoes throughout the country. The most famous volcano is Mt. Fuji, which is the highest point of Japan and one of the most beautiful mountains in the world. A positive side effect of the tectonics is the large number of hot springs.

Japan can be seen as a mountain ridge on the seafloor that is pushed up to emerge above sea level. Therefore about three quarters of the area is mountainous and covered with forests. Only 11% of the country is arable. Many rivers flow from the mountains to the sea. The rivers are short, fast flowing and hardly accessible by ship. The longest river is the Shinano River which flows 367 kilometres from the mountains of the Chubu region to the Sea of Japan. The rivers have formed valleys and basins in Japans landscape.

Japan has no land borders at all. It has a coastline of 29,751 kilometres. A warm ocean current known as the Kuroshio flows north-eastward along the southern part of the Japanese archipelago, and a branch of it, known as the Tsushima Current, flows into the Sea of Japan along the west side of the country. From the north, a cold current known as the Oyashio flows south along Japan's east coast, and a branch of it, called the Liman Current, enters the Sea of Japan from the north. The mixing of these warm and cold currents helps produce abundant fish resources in waters near Japan. Other natural resources are not abundant present in Japan. It does have some mineral resources and there is a lot of fish, but for fuels, chemicals and some food it is designated to imports.

A major feature of Japan's climate is the clear-cut temperature changes between the four seasons. From north to south, Japan covers a range of latitude of some 25 degrees and is influenced in the winter by seasonal winds blowing from Siberia and in the summer by seasonal winds blowing from the Pacific Ocean. In spite of its rather small area, Japan is characterized by four different climatic patterns. Average precipitation and temperature for different locations around the world are found in figure 5.2 and figure 5.3.

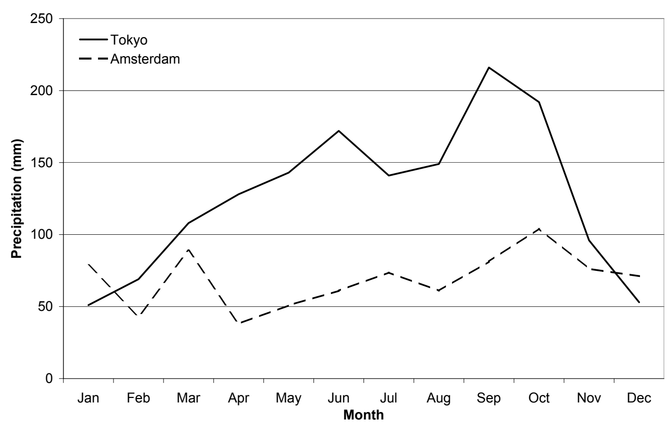


Figure 5.2: Average precipitation.

Hokkaido, with a subarctic weather pattern, has a yearly average temperature of eight degrees centigrade and receives an average annual precipitation of 1,150 millimeters. The Pacific Ocean side of Japan, from the Tohoku region of northern Honshu to Kyushu, belongs to the temperate zone, and its summers are hot, influenced by seasonal winds from the Pacific. The side of the country which faces the Sea of Japan has a climate with much rain and snow, produced when

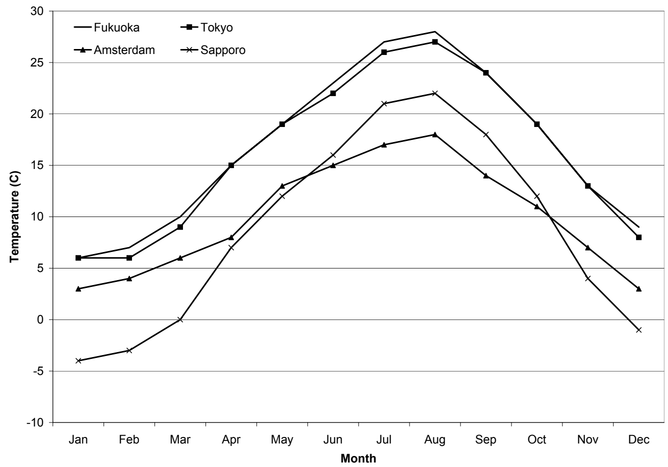


Figure 5.3: Average temperature.

cold, moisture-bearing seasonal winds from the continent are stopped in their advance by the Central Alps and other mountains which run along Japan's center like a backbone. The southwestern islands of Okinawa Prefecture belong to the subtropical climate zone and have a yearly average temperate of over 22 degrees, while receiving over 2,000 millimeters of precipitation.

The Netherlands

The Netherlands is a small country in the west of Europe. It is characterized by large slow flowing rivers flowing through the country and very little changes in elevation. Its position next to the North Sea is responsible for the mild sea climate but also for economic centers around the large ports of Rotterdam and Amsterdam. These harbours are mainly transhipment ports: cargo from large ocean going vessels is loaded on to much smaller river vessels, trains and trucks to be transported through the country and across the land borders. These harbours have been very important in the economic history of the Netherlands.

Because the country is very flat, it is easy to use for all kinds of cultivation and fast transport over rail, road and waterways. Because of these cultivations only little space is left for nature, even the forests are cultivated. This also makes the Netherlands one of the most densely inhabited countries in the world

5.2.2 Geographical influences on innovation

Japan

There are several geographical factors that have their influence on innovation in Japan. The most important ones are the ones related to the fact that Japan is situated on a junction of continental plates. Because of this Japan has many mountains and volcanoes, and Japan suffers from many earthquakes.

Because Japan is very mountainous the land is hard to use for building cities, infrastructure and also hard to cultivate. From the day people started cultivating the Japanese soil they had difficulties with the rough surface. To be able to bring enough food from the small bits of arable land to feed larger cities, the ways of cultivation had to become more efficient. But also the building of cities and (rail)roads in a mountainous area takes more effort than in a flat area. In this way the Japanese were forced to innovate from an early stage of civilization and to continue this innovation to be able to house and feed a still growing number of people.

A second reason for the Japanese to innovate is because Japan knows some severe natural hazards. Earthquakes, volcanoes and tsunamis are not uncommon in Japan. All these events can cause severe damage or even destroy a whole city. Japan has known these hazards since its formation. People have been able to study their occurrences and their effects. To decrease the effects of these events people have done 2 things: they tried to make structures that could sustain these disasters and they tried to predict them so they could be prepared to take some damage. New innovations can help in this science while other innovations demand even better protection against the forces of nature and so the tectonical unrest underneath Japan keeps pushing technology.

Japan does not have many valuable natural resources. It does have an excellent location for trade however. Its narrow shape makes most places in Japan directly accessible by ship and thanks to its situation between Asia on one side and the Americas on the other, many trade routes could be set up. In this way Japan didn't need natural resources, but it could set up trade routes. Japan could make money by importing basic resources, process these to consumer products and export them all over the world. This can be seen in the import/export figures of Japan: the most important imports of Japan are fuels and chemicals, while the most important exports are motor vehicles and semiconductors. And of course also in this area innovation is the key word. By innovating Japan can try to keep a step ahead and create a demand for new products. Innovation can also help to shorten delivery times. Because even though its location is perfect in the modern internet economy customers want faster and faster deliveries.

You can see that geological factors have influenced innovation in Japan. Because the geographical aspects of a country hardly change in time, these factors will keep playing their role in the innovation in Japan. Earthquakes will strike in future, and the Japanese will have to be prepared and its strategic location between Asia and America will not change.

The Netherlands

The Netherlands was also pushed to innovate because of geographical factors. Its geographical position is one of the most important. The location on the European coast at the end of some large rivers has played an important role in the development of the Netherlands as a trading country. To keep up with the rest of Europe and to maintain at the top of the largest throughput harbours, the Dutch harbours and cities had to grow to the demands of civilisation.

Another factor that has pushed innovation in the Netherlands is the lack of space and the low position with respect to sea level. The Dutch were the first people to create polders; new land in parts of the sea protected by dikes. The development of these dikes and drainage systems are almost uniquely found in the Netherlands and Dutch engineers are famous around the world for their land winning and dredging activities.

5.2.3 Comparison

In this section differences in innovation caused by geographical differences between Japan and the Netherlands are discussed. First the main geographical aspects are summarized in a table. After that it is discussed how these differences lead to different types of innovation.

Aspect	Japan	The Netherlands
Area	377,835 sq km	41,532 sq km
Coastline	29,751 km	451 km
Land borders	0	1027 km
Population	125 million	16 million
Population density	336 / sq km	466 people / sq km
Arable land	11%	25%
Permanent crops	1%	3%
Permanent pastures	2%	25%
Forrest and woodland	67%	8%
Natural resources	Negligible mineral resources, fish	Natural gas, petroleum, arable land
Natural hazards	Volcanoes, earthquakes, tsunamis	The extensive system of dikes and dams protects nearly one-half of the total area from being flooded
Railways	23,670 km	2,739 km
Highways	1,152,207 km	125,575 km
Waterways	1,770 km	5,046 km
Climate	Varies from tropical to cool temperate	Temperate, marine
Elevation	-4 to 3,776 m	-7 to 321 m

Table 5.1: Comparison table on geography.

As can be seen in table 5.1, the area of the Netherlands is only one tenth of that of Japan. But the Netherlands have relatively more area that is usable for cultivation. The whole surface of the Netherlands is flat. It is easy to use large agricultural machines on the land for mass production and irrigation water will not flow away from where it is deposited. Japan only has a few planes where this is possible. So the Japanese had to find effective ways of growing enough food and find other ways of income. Luckily both countries have excellent climates for agriculture and in both countries there is plenty of water.

For building cities and infrastructures both countries face their own problems. In both countries you cannot just place your buildings and roads. In Japan earthquakes put very high demands on these structures. Every building and every bridge has to sustain these events. In the Netherlands engineers face the very weak underground often called 'thick water'. If structures are not prepared for this underground they will subside, causing large stresses in the structures.

So in both countries engineers faced their own problems, but in both cases they were forced to find new solutions for building larger structures.

Because Japan is a much larger country than the Netherlands it has about 10 times as much railways and highways. The Netherlands do have about 3 times more waterways due to its flat surface. But because Japan is an island, transportation by ship is very well possible. Most of the Japanese cities have their own sea harbour. The Dutch harbours are also transhipment ports. Cargo from the big ocean ships is loaded on to smaller boats for further transportation to harbours along the rivers, also to its neighbouring countries Germany and Belgium. Both countries have their advantage. Japan has sea harbours in most cities while the Netherlands could take advantage of the transhipping of cargo to its neighbours.

Both Japan and the Netherlands have their own natural enemies. Japan has its volcanoes and earthquakes. The Netherlands have to be continuously aware of the fact that half of the country is below sea level. Both countries have learnt to cope with these hazards and found their ways to protect themselves. Both countries have been pushed to innovate, but each in its own way.

5.2.4 Conclusion

The main geographical differences and resemblances between Japan and the Netherlands have been discussed in this section. The geography of both countries shows many differences. Civilization developed in different ways on different surfaces, but in both cases, trying to cultivate the country meant people had to innovate. In Japan the mountains, volcanoes and earthquakes caused people to innovate and in the Netherlands the small area and the shallow seas exhorted the people to innovate. In general, it can be said that cultivating a land and coping with its geographical difficulties means you have to innovate, like Japan and the Netherlands did.

5.3 History of Japan

by Joost de Klepper, Janarthanan Sundaram and Mathijs Marsman

In this section we will look at the history of Japan and how this history affected and affects the way Japan innovates. The research question that will be answered is:

> *What differences in history are important factors that support or inhibit innovation?*

5.3.1 Early history

The Japanese history starts later than the history of the Asian mainland. This is of course due to the fact that the inhabitants of Japan originate from the Asian main land. The narrow sea between the peninsula of South Korea and Japan and also the narrow sea between Siberia and Japan made it easy for tribes to make the crossover. The mixing of all these tribes lead to the current Japanese race.

In the early history of Japan there was no written text and it was imported from the Chinese mainland. But the one character writing was not entirely suitable for the Japanese language and so the Japanese adjusted the language to suit their language. The early history can only be based on legends, because of the lack of written texts, and one of these legends state that Japan was founded at 660 BC. At that time Japan had a clan culture and small sovereign communities inhabited Japan.

At 300BC the technique for cultivating rice reached Japan from the Asian mainland. This technique made rapid growth of the clans possible. This is the start Yayoi culture. In 300 AD the first government in the form of an empire was established by the emperor Yamato. Japan maintained a good diplomatic relationship with Korea; it even sent troops to Korea for helping them in a war between Korean states. This relationship led to the action of one Korean king who sent a Buddha statue with it is religious documents to Japan. Until now the Japanese people had a religion that was based on ancient myths. Again the Japanese ingenious way of changing things into their own way of life was being proven by the fact that Buddhism was changed to fit in with their own religion. Japanese accepted Buddhism but they did not abandon their earlier Shinto belief.

The first capital city was founded in 710 AD. Before that Japan never had a permanent capital city. They thought that it was impropriate to start a new court on the polluted grounds of a dead emperor. In 757 the court had such intrigues and crimes that the capital city was moved in 784. In 794 they finally moved Heian-Kyo later known as Kyoto.

1002 is the beginning of the Kamakura era, in this period the power laid in the hands of the shogunates. The already existing system of landlords and labourers turned into a military order, where everyone was expected to report when there was a need for military. Out of this new hierarchy based on the clan system, the samurai became the leaders. These samurai had a code based on pride for own name, honour and loyalty. This lead to customs like the Hara-Kiri, where the noble may kill themselves.

Kubli Kahn conquered China, and tried to invade Japan in 1274. The Mongols were not seafaring and they used the Korean ships and crew to cross. But both times they tried to invade Japan, they were surprised by typhoons and the mighty Mongol army got defeated by bad weather.

5.3.2 Edo era

Japan plunged in to an era of civil struggle and civil war from 1467 to 1600. After this era, the Edo era started. In this era Japan isolated itself for 2 centuries from the rest of the world. Only the Dutch were able to establish a commercial relationship with the Japanese. Also in this period the world was in an industrial revolution and these influences started to invade Japan. From 1573 to 1600 Japan became a unified country. In 1592 Japan tried to invade Korea under the leadership of emperor Hideyoshi, and they managed to capture a large area in Korea. Japan was rich, stable and secure during the reign strict of Hideyoshi.

The first foreigners in Japan were the Portuguese; they were called "the men with the iron stick". Of course this refers to the gun. These Portuguese used Spanish missionaries to communicate with the Japanese, and apart from China, these Portuguese were the only one who could deliver silk to Japan. Therefore the Japanese established a trade relationship in 1543 with the Portuguese. Nagasaki, a town where traders settled, was becoming a metropolis and was governed by Jesuits. The Japanese heard soon about the conquests of Portugal and their wars against Islam. So the Japanese began to show their fear towards the Portuguese.

After closing the borders from the outside world, Japan begun to think about unifying its nation. Oda Nobunaga had the ambition to turn Japan into one unity. He belongs to the three men who unified Japan: Oda Hideyoshi and Ieyasu. He started at an age of 20, when he became the head of his family, by conquering all family assets of the family that didn't accept him as the head of the family. After a while he conquered a whole province. In this period Japanese already had mastered the technology of gun production and built factories to produce them. With these new weapons and using European army techniques Oda could conquer whole Japan. Through conspiracy in his own trusted group Oda died. Hideyoshi was one of the generals of Oda, but he wasn't in Kyoto when the murder on Oda took place. But soon he took revenge on the general who was a traitor. Afterwards Hideyoshi took power but he was forced to share this power with Ieyashu. After this unification Japan tried to invade China twice through Korea. But the conquests were short, and they were conquered back.

Later rulers saw the benefits of international trade and they encouraged merchants to set up commercial settlements. But soon people feared the downside of this, the massive emigration to Japan. So this was banned, no foreigner could immigrate to Japan and this also lead to a ban on emigration of Japanese to other countries. Especially Japanese who had converted to foreign believes feared of execution, and wanted to flee the country. The total closure of Japan nearly was for 100% secure. Only the Dutch were permitted to establish a settlement on an island called Deshima. They were able to continue commerce under strict regulation. The Dutch merchants were humiliated and were rationed. But they were willing to endure the insults of the Japanese because of the profitable trade. In the 17th century the Japanese were grown accustomed to the Dutch and they softened the treatment. And soon the imports of Dutch books were permitted and the Western science took hold of the Japanese society. After this acceptance by the government the inquisitiveness of the Japanese society took over. People were willing to sell all tehir property to buy Dutch books.

Figure 5.4: Hideyoshi.

5.3.3 19th century

It was very difficult for Japan in the early 19th century; internal tumult caused by the famine was damaging the current form of rule. The farmers were not after the new form of government, they were just hungry, and wanted a solution for their problem. This was not a pleasant situation because of the external threat. Outside of Japan the imperialism was going on in full strength. The Dutch also lost their colonies in the Indies. The only place where they could hold ground was Deshima. But the Dutch were very important to the Japanese because they needed the Dutch for the import of weapons and books. The Dutch king Willem II send a letter to Japan advising to open the marked, otherwise the western powers will do it by force. Even before the English could force the Japanese, The United States started threatening the Japanese. On March the 31st of 1854 Japan signed an agreement with the States.

The shogunate employed a lot of foreign technicians. They realised that the gap in technological knowledge was tremendous, and were willing to learn eagerly. Japanese samurai were travelling through London, Berlin and Paris to learn all about the foreign technologies.

After the disappearance of the shogunate the power shifted back to the clans. But people realized that there should be a central government. They made a constitution taking the Western model as model. They banned the only function of the samurai: military. A parliamentary system was introduced with 2 chambers.

In 1889 the first elections were held for the Diet. The emperor was holy and inviolable. He could change the constitution and discharge the diet. And the only people who could vote, were the people who paid taxes.

In the new modern era of Japan, people had the feeling that they were not regarded equal by the Wworld. They still had humiliating contracts with Western countries. And the Chinese threat increased by the growing influence of the Chinese in Korea. So the Japanese signed a new agreement, which stated that England would come to help when Japan was attacked by 2 nations.

In 1904 Japan attacked the Russian fleet without a declaration of war. They made great victories but the war was too large for Japan and the peace treaty proposed by Teddy Roosevelt was signed. In 1905 the peace was declared and the presence of Japanese in Korea accepted. This marked an era where an Asian country proved to better then the Western nations. This was the fire that fed the nationalistic ideas in Asia.

5.3.4 World War I

When World War I started, Japan stood at its agreement and took sides with England against the German invasion on the colonies. They conquered German territory on Chinese ground, by doing so controlled large iron factories on those territories. But they never gave these territories back to China and that severed the good relations with China. Japan changed from oppressed to oppressor.

The democratic system of Japan began to run well. This was found very important because they wanted to show to the rest of the world that they were equal to the Western world. But in practice there were lot of problems. The real people in power were not interested in the freedom of people. Every party leader came out of bureaucratic arrangements and not out of popularity among ordinary people. Like the business people the politicians disliked socialistic movements, which were rising with the industrialisation of the country. There were lots of modern ideas like feminism and Marxism but these thoughts were punished by a special police force against dangerous thought. People were convinced that government with political parties would not work.

When the emperor became ill and weak the gross of the population let the government change into a 'healthy' militarism. The economical downfall of Japan gave young radical militaries the power to start socialism under the regime of military. Only the emperor and the military would rule. In 1927 a group of young military started an alliance. They concluded that the only way to get Japan on the right track was by using force.

In the years 1931 to 1941 the personal freedom and liberalism were abandoned. It even got dangerous to think liberal. The emperor could not intervene in this dark period because the only way he could execute power was through his council, but the people seated in the council were all high ranking military officers. Japan was in the mean time conquered territories in China. In Italy the Japanese signed an anti-Komintern-pact with Italy and Germany. Hitler and Mussolini acknowledged that Japan was the leader of Asia. This alliance was obviously set up against the US. The relationship with democratic countries worsened very quickly. In 1939 the trade agreement with the US was declaimed.

5.3.5 World War II

The German uprising against Russia was an opportunity for Japan to join the war, because there were riches in Siberia. They invaded French territory on Vichy. The states in turn started an oil embargo against Japan. Japan had 2 choices. They could retreat, and settle with the States or they could attack the Dutch Indies because of the oil there. Japan first negotiated with the US, but they were very stern in their demands. So Japan was determined to go to war. On December 7, 1941 Japan attacked Pearl Harbour without declaring war. The attack was a success. At first Japan was making one victory after another. In 1942 Japan conquered whole Dutch Indies. All this was possible due to the loss of the American fleet in the Pacific.

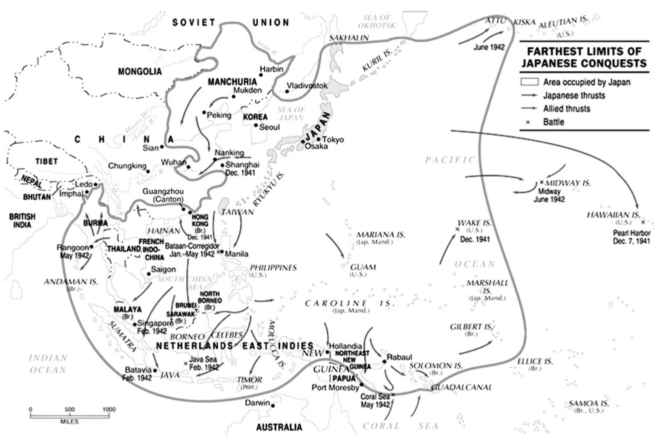


Figure 5.5: Conquered area in World War II.

When a very important support location was taken by the Americans the Japanese started thinking of ending the war, but they didn't want to pay a high price. First plan was to ask Russia; with whom they didn't have a war, to mediate negotiations with the Allies. On the 26th of July 1945 they declared that Japan should not be destroyed or enslaved as a race. With that the Japanese could undergo an honorful surrender.

On the 6th of August an atomic bomb was dropped on Hiroshima and on the 9th another one was dropped on Nagasaki. Russia immediately declared war on Japan and conquered Mantsjoerije. After this the Japanese signed surrender.

The war was devastating for Japan, since the bombing of cities built with wood left almost nothing standing. But the Japanese army was still strong, and that made the allies edgy. Everyone in Japan was certain about one thing; they would have to save the empirical government. But after the two atom bombs Japan surrendered unconditionally.

Japan was occupied by the American occupational army from August 1945. People in Japan were afraid of retaliatory actions of the Americans, but that fear was proven wrong, since Americans behaved disciplined. And everywhere in Japan everyone laid down their weapons.

5.3.6 Post-war

Three million Japanese had to return to Japan from the outposts. Food aid from the US helped to stop the famine. Everything in Japan was being changed by the American into their model. And they never took the ancient culture from Japan into account. Until 1952 people were not anti-American. But after 1952 it changed drastically. People started to get annoyed by the assumption of Americans that there was only one good type of democracy, namely their own.

To their surprise the Americans wanted the Japanese to be an ally to a new threat, so a very well militarized Japan was very important. Because the constitution prohibited Japan from having an army, they mobilized a police force of 70,000 men. Also the navy and the air force were taken into business. This shocked the citizens, because everyone had criticized the new constitution, but they always had been satisfied with the ban of an army. Everyone was hoping on a peaceful future after a war like that. So people felt that the Americans had overstayed their occupation.

The new constitution was working fine and the emperor had a symbolic role, as the symbol of the state.

Japan rebuilt in a miraculous way, and became in a short time one of the world key economical players. The most progress was found in the electronics field.

5.3.7 Conclusion

Every time Japan met new civilisations with new ideas and technologies, Japan managed to adapt these ideas and technologies to fit in their civilisation. They show a great curiosity towards new ideas. This shows in the way they assimilated new technologies and ideas like cultivating rise, Buddhism, guns and the new military system. The curiosity toward new technologies is shown when the Japanese were willing to sell all of their property to buy Dutch books. They assimilate new ideas with a way which made it more efficient. We can see this it in the Second World War, where they demonstrated their view of a military system.

Another factor is the competitiveness of the Japanese. They felt that they were better then the rest of the world, and treated foreigners as such. This shows in the way they treated the Dutch on Deshima. Everything that was considered better then what they had were evaluated carefully and then assimilated. The competitiveness is shown several times in history; one example is the international commerce that was induced by the government.

These factors are still the same in Japan, and this made the rapid growth of Japan possible after the surrender to the Americans. And still the manage to impress the West with their ability perfect new technologies.

5.4 Socio-cultural factors

by Joost de Klepper, Janarthanan Sundaram and Mathijs Marsman

The question:

> *How do (socio-)culture differences between Japan and the Netherlands influence innovation?*

can be answered by looking at:

- The population demographics;
- Employees' attitude to work;
- Japanese management culture.

5.4.1 Population demographics

The main demographic figures of Japan [7, 8] are:

- Japan has a population of 127.2 million people;
- About 75% of the population lives in the ten biggest cities;
- Japan has a high population density (1,523 people per square kilometer for habitable land);
- 1.3% of the population is foreign. The foreign people mainly come from Korea and China;
- The life expectation at birth is 81 years;
- Shintoism and Buddhism are with 84% the main religions in Japan;
- Japan has an unemployment rate of 4.7%;
- The school life expectancy is 14,3 years.

The age and sex distribution of Japan for the year 2003 is given in figure 5.6. The shape of the age and sex distribution is typical for a Western country, just like the rest of the demographic figures of Japan.

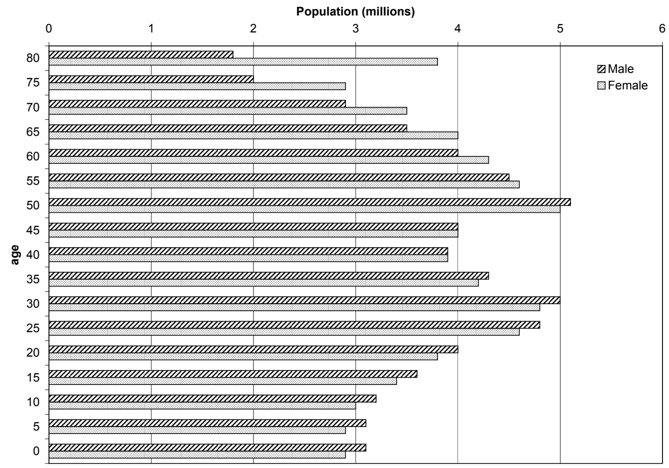


Figure 5.6: Sex distribution of Japan.

5.4.2 Employees' attitude to work

The employees in Japan have a very different attitude to work in comparison to employees in the Netherlands. This is caused by different reasons [9].

Japanese companies generally directly recruit employees from school. In Japan they don't use an open job market. If a company has a vacancy, they hang up posters only at schools and universities. Students can send then a letter of application to that company. This is a disadvantage for unemployed people: it is hard to get a job, because they can't find any vacancies.

Secondly it is normal that a company gives an employee a lifetime employment. The new employees get a low position and a mentor. In the first years the new employee learns job skills by working in different departments. The employee can get promotion if his mentor gets promotion. The employee will never get a higher or same position as his mentor. The employee grows slowly in a company. The employees see the company as a family. They have extensive social exchanges with colleagues. In Japan it is a big shame to be excluded from a group, so the employees have a large commitment.

The positive aspect of this system is that a manager has much knowledge and skills, so the manager can make better decisions. Other positive aspects are the information and skills stay at the company and the employees have more commitment to a company The negative aspect of this system is that a when company recruited the wrong employee it will cost the company a lot. Other negative aspects are that for small company it is impossible to grant lifetime employment and it is hard to fire employees, because the company invested a lot in an employee and it is a humiliation for the employee.

In Japan Total Quality Management (TQM) and Just In Time (JIT) systems are been invented. Companies use these systems years before companies from other countries. One aspect of TQM and JIT philosophy is the importance of employees. In combination with lifetime employment the company's commitment to its employees is very high. This motivates employees.

Finally, Japanese companies use a different compensation system. Normally one third of salary is a bonus. When a company has losses it can easily cut down labor costs. Another difference is the more equal wages. A CEO earns within tolerable ranges in comparison with other employees. This is a part of the Japanese ideology of egalitarianism and togetherness.

5.4.3 Japanese management culture

Japanese management has different ways to manage a company: The main different are[10]:

- Consensus: the CEO tries to reach consensus, so everyone agrees with the decisions. This is mostly impossible;
- No publicly criticism: it is not usual to criticise someone in Japan;
- If an employee doesn't functioning well, he will not be fired. He gets extra support;
- Social management: managers find social aspect more important then financial;
- Low difference in wages: the honour of a function is more important than a higher remuneration;
- Long term thinking;
- Quality: quality is the most important in a Japanese company;
- Profits are less important: the main goal is not profits, but this is changing: profits become more important;
- Collective responsibility: a manager is responsible for employment instead of higher profits;
- Decisions are executed: if a decision is made, it will be executed, because it was made in consensus.

These ways of management are derived from Confucianism. The Japanese companies are changing there management style into a more European/American style, because Japanese companies have more problems with competition than they used to have.

5.4.4 The Netherlands

The main demographic figures of the Netherlands are:

- The Netherlands has a population of 16,150,511 people;

- 19% of the population is foreign;
- The life expectation at birth is 79 years;
- The Netherlands has an unemployment rate of 6.6%;
- The school life expectancy is 15.9 years;
- Catholic and protestant are with 31% and 21 % the main religions in the Netherlands and 40% are unaffiliated.

The age and sex distribution of the Netherlands is given in figure 5.7.

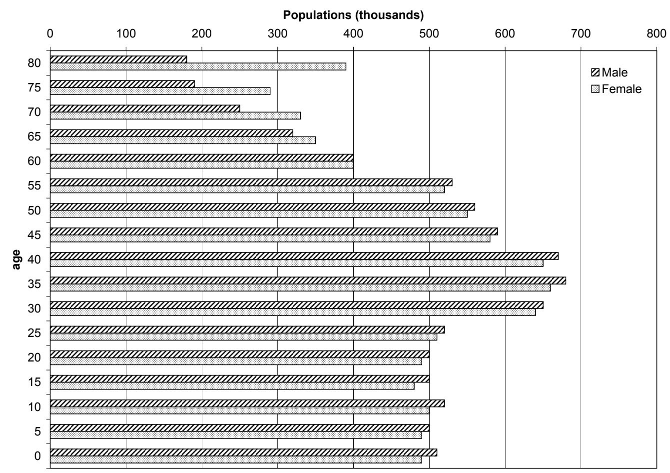


Figure 5.7: Sex distribution of the Netherlands.

The management style in the Netherlands can be described like:

- Direct, public criticism is allowed;
- An employee is functioning well or not;
- Short term thinking;
- Employees are instrument and asset;
- Maximization of profits;
- Top jobs with extreme remuneration;
- Individual responsibilities;
- Conscious decision making.

5.4.5 Conclusion

Japan has all the demographic properties of high developed country. The employees have high commitment to work and the management uses a very social policy. These factors support and inhibit innovation. It takes a long time to grow in a company and people that are not suitable for their job can generally keep their position. These factors make it more difficult to have innovation. The main differences between the Netherlands and Japan are religion, management style and the percentage of foreign people.

5.5 Technological factors

by Joost de Klepper, Janarthanan Sundaram and Mathijs Marsman

The question:

> *What technological factors support or inhibit innovation at the national level?*

can be answered by looking at:

- Japan competitiveness;
- Research and Development expenditures;
- Competitive advantages of Japanese companies in the world market.

We will look at these factors in the following subsections.

5.5.1 Japan competitiveness

Japan is number 9 [11] in the human development index rank, number 11 in the Gender-related Development Index (GDI) rank and number 2 in high tech product export. International competitiveness rankings [12] are shown in table 5.2.

As number 4, Japan also scores high on the technology achievement index. The technology achievement index is based on creation of technology, diffusion of recent and old innovations and human skills. This way it gives a good overall view of technology development of a country.

5.5.2 Research and Development expenditures

In Japan a great amount of money is spent on research and development. The major research and development regions are [12]:

- Information and communications technology (ICT);
- Environment;
- Medical care and welfare;
- Nanotechnology;
- Wholesale and retail.

Area			First	Second	Third	Fourth
Current	Company operations and strategy	Companies that sell internationally develop their own international brand	Switzerland	Japan	Germany	Finland
		To sell internationally, companies control their own foreign distribution and marketing organizations	France	Japan	The Netherlands	US
	Business-environment	Machine tools are provided domestically	Japan	China	US	Italy
		Railroads are highly developed	France	Japan	Switzerland	Hong Kong
Growth	Technology	Companies invest heavily in R&D relative to their international peers	Switzerland	Japan	US	Germany
		Companies are aggressive in absorbing new technology	Finland	US	Iceland	Japan
	Institutions	Senior management spends very little of its time dealing with government bureaucracy	Japan	The Netherlands	Switzerland	Belgium

Table 5.2: Competitiveness ranking.

Research and development expenditures in Japan [12] are given in figure 5.8.

The high expenditures on research and development can also be seen in the numbers of patent registrations [12] (see figure 5.9).

5.5.3 Competitive advantages

Japan has had a very strong competitive position for years. This was because of the companies in Japan put a lot of effort in improving the production system and products. The government stimulated the improvements by introducing the JIS (Japan Industrial Standard) in 1955. Every export product has to meet the JIS demand. This way Japan became the best in quality management. The modern quality theory is Kaizen (=continuous improvement). Kaizen contains all aspects of quality activities of a company [9]:

- Customer orientation
- Total Quality Control;
- Robotics;
- Quality Circles;
- Suggestion system;
- Automation;
- Discipline;
- Total Productive Maintenance;

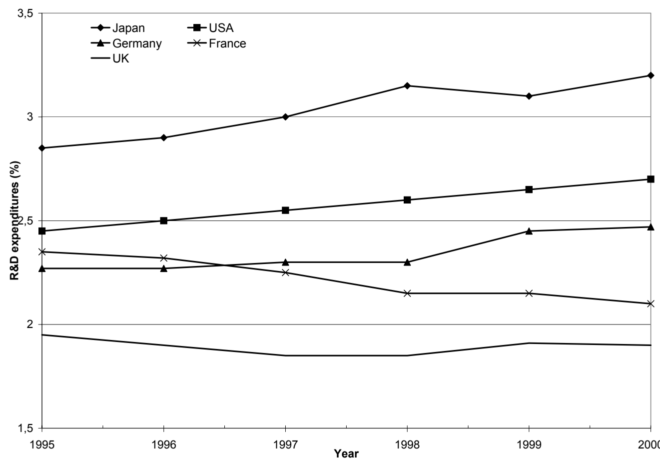


Figure 5.8: Research and development expenditures.

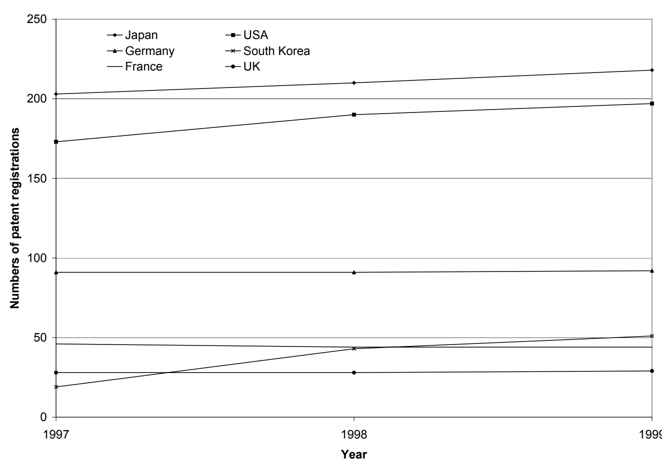


Figure 5.9: Numbers of patent registrations.

- Kanban;
- Quality improvement;
- Just In Time;
- Zero defects;
- Small group activities;
- Cooperative labour management relation;
- Productivity improvement;
- New product development.

Every aspect is a technology innovation on its own. With this theory it is possible to make a company more competitive, because of effort in improvement of all aspect of a company. These advantages of Japanese companies become smaller, because companies of other countries are also implementing Kaizen. The influence of Kaizen can be seen in the lost work days [12] in figure 5.10.

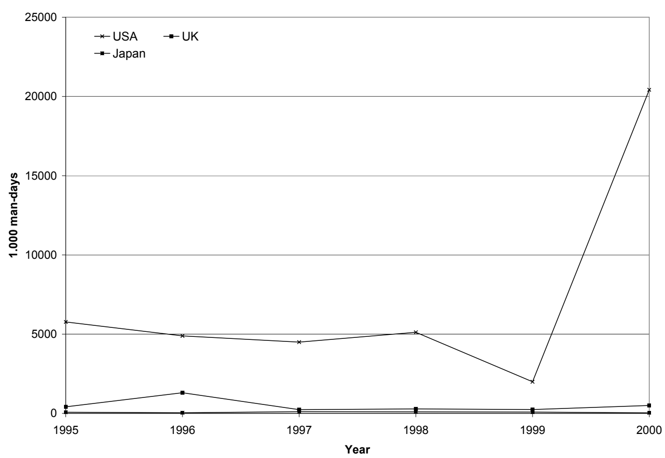


Figure 5.10: Lost work days.

Another competitive advantage of Japan is the way Japan adopts new technology from outside the country. Japanese are very curious about new technology. This way Japanese companies are very effective in adopting new technologies.

5.5.4 The Netherlands

The Netherlands is on number 6 in the technology achievement index. In the Netherlands a smaller amount of money (4,582 million Euro) is spent on R&D. The major R&D regions are:

- Information and communications technology (ICT);
- Electronics;

- Process technology;
- Medic/pharmacy technology.

The Dutch companies are also implementing various aspects of Kaizen, so the competitive advantage of Japanese companies is decreasing.

5.5.5 Conclusion

The high research and development expenditures, high skilled employees and Kaizen highly support innovation. This can be seen in the number of patents and the competitiveness ranks. In comparison to Japan the Netherlands invest less in R&D. This is a big competitive disadvantage. The Netherlands and Japan major R&D regions do not differ much.

5.6 General economic situation

This chapter gives a overview of the Economic situation of Japan and the Netherlands from the past (after World War II) till the present.

5.6.1 History

A brief overview of the history of international trade after World War II in Japan and the Netherlands is given.

Japan

After losing the war in 1945, Japan was occupied by the Allies. They needed the economy of Japan up and running as soon as possible, because else they wouldn't receive any war damage retributions and an economically healthy Japan would make a valuable trading partner. Customs were reinstated in 1946, but international trade remained under strict control of the occupation forces. This control was gradually relaxed, until it was completely withdrawn in 1950 [13].

The Japanese economy started once again to grow and an additional impulse to this growth was given to international trade with the accession of Japan to the IMF (International Monetary Fund) in 1952 and GATT (General Agreement on Tariffs and Trade) in 1955. Japan also joined the OECD in 1964 (Organization for Economic Co-operation and Development), which has since then constrained its foreign economic policies to some extent. Japan has developed ties with ASEAN since 1977 and has been an important dialogue partner for ASEAN since 1987. Two years later, in 1989, Japan joined the APEC (Asian Pacific Economic Cooperation). The goals of these organizations will be discussed in section 5.7.1.

After World War II, the growth of East Asia's economy was the world's fastest. In this region, the Japanese economy was the absolute leader and between 1950 and 1970 the economy even grew with an average of 10 percent a year.

Till the mid 1980s the United States complained frequently about the unfair competition that Japanese companies imposed on the United States markets, the so called dumping of goods. These conflicts however could always be resolved with a close check of the rules of GATT and the national laws: Japan was always in its right. However Japan imposed export restrictions on Japanese companies as a gesture to the United States.

In the late part of the 80s these relationships changed. With the economy of Japan experiencing its first recession since before World War II, the trading positions shifted. Companies in the United States started to export more to Japan. Those foreign companies found that not all the markets in Japan were easily accessible and demanded that those impediments were removed. A good example of this is the Large-Scale Retail Store Law which will be discussed in subsection 5.7.4. Japan has since then passed several laws that greatly decentralize the economy.

As the economy stagnated, the Japanese government tried to save the country's economy by investing about 200,000 billion Yen (about 2 billion US Dollars). It did not work out, the country's debts raised to more than 130 percent of the Gross Domestic Product (GDP) and the economy growth slowed down to an average of just 1.7%. Explanations can be found in the aftereffects of overinvestment during the late 1980s and domestic policies intended to wring speculative excesses from the stock and real estate markets. Effects of the recession are a low productivity growth, inflation and unemployment. During the ICT-revolution, many Japanese companies went bankrupt because they were not capable of anticipating in this quick business. Many small companies went bankrupt. Japan's capitalism created cartels to protect the national and international competition position of many companies, because of this prices rose.

The Netherlands

The Dutch economy also was in ruins after the liberation at the end of World War II and also received help from the US through the Marshall Plan [14]. One of the prerequisites for this relief was that the European countries had to work together on a plan for the economic recovery of all of the participating countries.

In Europe a few countries began to deploy initiatives to further economic co-operation with each other to create economic growth. In 1952 the European Coal and Steel Community (ECSC) was founded by France, the Federal Republic of Germany, Italy, Belgium, Luxembourg and the Netherlands [15]. This was the creation of a single economic market for the activities in the coal, iron and steel sectors, which was not subject to national regulations or restrictions.

The member states of the ECSC found their cooperation to be a success and continued to further integrate their economies, forming the European Economic Community (EEC) and European Atomic Energy Community (EURATOM) in 1957. In 1967 the European Union (EU) was formed by merging the institutions of the ECSC, EEC and EURATOM. The EU focused at first on a common commercial policy for the sectors of the ECSC and the agricultural sector. Other policies were later added and it now has great influence on all aspects of the international policies of all the member countries [16]. In 1992 almost all the trade barriers were removed between the member states, turning their common market into a single market. This was also the year that the EMU (European Monetary Union) was founded to introduce a single European currency. In 2002 the Euro was introduced in twelve of the then 15 member countries, including the Netherlands. The international economic policy is completely regulated by European government.

The Netherlands have been a founding member of the IMF, 1944, [17, 18] the GATT, 1948, [19] and the OECD, 1960, [20].

The Netherlands is a prosperous and open economy depending heavily on foreign trade. The economy is noted for stable industrial relations, moderate unemployment and inflation, a sizable current account surplus, and an important role as a European transportation hub with its harbor in Rotterdam. The highly mechanized agricultural sector employs no more than 4% of the labor force but provides large surpluses for the food-processing industry. Other industrial activity is in food processing, chemicals, petroleum refining and electrical machinery. The country continues to be one of the leading European nations for attracting foreign direct investment.

Comparison

As stated above the economies of both Japan and the Netherlands were in ruins after World War II. The Netherlands immediately became a member of international initiatives that helped its economy to recover and tried to prevent such a war in the future. Japan remained under the influence of the United States and was therefore dependent on the United States for its economic recovery. After the United States gave back political control to the Japanese, they became also a member of numerous international organizations.

Japan and the Netherlands are both member of numerous international economic organizations, but a big difference can be noted. The Netherlands often are involved in the founding and developing of such organizations and initiatives and Japan usually joins after the organizations has been up and running a couple of years. Examples are its later entry in the IMF, GATT and ASEAN.

5.6.2 Current situation

The section describes the state of the economy of recent years and prospects of the near future.

Japan

The current economic situation in Japan is a state of recession, which started in 1990. Although taxes were lowered to almost zero the economy has not responded. The banks of Japan suffer from the problem of non-performing loans but reform of the financial sector has not been done because of the fear of losing consumer faith in the financial system.

Prime Minister Koizumi will undertake drastic measures to reform the economy [21]. Not only is this necessary to jumpstart the economy, the national debt is also dangerously high. Because of the aging population, Japan will not be able to fulfil its pension duties in a few years.

The plans for the future are:

- Opening the economy to foreign competitors and deregulation of the market;
- Increasing the relations with the US, China, Koreas and ASEAN members;
- Construction of a circle of innovation and demand to increase industrial competitiveness [22].

The trade balance of Japan has always been very positive. The US and EU have pressured Japan to open its markets to import. This has led to deregulation, lowering of income taxes and shorter working hours. Also foreign direct investments are stimulated and these have increased rapidly. In 2001 the Netherlands were the largest Foreign Direct Investor (FDI), followed by the US. This also an indication that the investments are relatively small.

Most important trade partner is the US, who accounts for a quarter of the entire international trade of Japan. Asian countries such as China have increasing relations. However since 2000 the imports from Europe and the US have decreased rapidly. This is due to the move of production to China.

While most Western countries today have trouble with the economy, Japan has shown an economic spurt [23] of 6.1% annually in the first quarter of 2004, which is the eighth straight quarter of growth. This is due to increased exports to the US and especially to China. In China there is a growing demand of Japanese goods and this may be a turning point of the recession.

The Netherlands

The Netherlands have seen steady economic growth during the 90s, which is partly attributed to the "Polder Model". This model describes the Dutch culture in which negotiating and compromising takes the place of debating and polarizing, leading to agreements between labour and liberal parties. In 2002 however, the Netherlands was feeling the effects of the global economic slowdown and experienced stagnation. Unemployment has risen to 6.6% [24] in the second quarter of 2004. The Dutch government has trouble fighting the stagnation because it is limited

	Japan	The Netherlands
Economic importance (index):	57.1 (2nd of the world)	5.9 (13th of the world)
Exchange rates: (per dollar)	125.39 YEN (2001)	EUR 1.06 (2001)
Inflation (1990-2000):	0,70%	2,40%
Inflation rate (consumer prices 2002):	-0,90%	3,40%
Industrial production growth rate (2002):	-1,40%	0%
GDP (2002):	$3.651 trillion	$437.8 billion
GDP (agriculture):	1,40%	3,10%
GDP (industry):	30,90%	25,70%
GDP (services):	67,7%	71,2%
Imports of goods and services (% of GDP):	9,81%	59,73%
Exports of goods and services 2001 (% of GDP):	10,44%	65,06%

Table 5.3: Some economic facts.

in its expenses due to the Lissabon agreement which sets the maximum budget deficit to 3%. The competitiveness of the Netherlands has declined, partly due to high labour costs. Policy makers try to lower wage demands to improve the competitive level, but have little room to offer social benefits in return, due to the high costs of such plans.

Innovation is the current keyword when discussing ways to escape the stagnation. The government launched a platform featuring members of politics, education, science and industry to improve the commercialization of technological discoveries.

Comparison

Japan and the Netherlands have striking similarities and crucial differences regarding the current economic situation. Both countries are thoroughly linked to the world economy because of the importance of international trade to the national economy. Stagnation on a global scale can result in national economic recession. The Dutch stagnation is small compared to the lost decade of Japan. The Japanese recession of 1991 has been prolonged due to the South East Asia crisis of 1997 and the US stagnation of 2001. In the 90s the Netherlands fared well but was hit hard by the slow world economy in 2001 and has been slow since.

Both countries try to escape the recession by capitalizing on innovation. Japan and the Netherlands have high labour prices so stimulating innovative markets in which price is not a factor should provide trade opportunities. Currently however, government budgets are very tight because of a rapidly aging population and rising pension costs.

There is also a difference in strategy to escape the recession. Japan tries to increase domestic spending by shortening working hours while the Netherlands do the opposite. The Dutch government tries to lower wages to increase competitiveness, but this will result in lower domestic spending. It is too soon to judge both options, both the Japanese and Dutch economy show signs of improvement in 2004.

5.7 International economy

by Jasper Klewer and Michel Franken

In this section we present the results of the study into the international economy of Japan and the Netherlands. The research question that will be answered is:

> *What are important economic forces that support or inhibit innovation on the international level?*

To be able to answer this question, several aspects of the international economies of Japan and the Netherlands have been studied.

First, an overview will be given of the major international trade organizations of which Japan and the Netherlands are members or have intensive contacts with otherwise. An insight in the situation concerning trade barriers is presented as a preparation for the overview of the imports and exports. This section is concluded with a report about the statistics concerning international trade.

Finally conclusions are presented to be able to understand what forces in the international economies of Japan and the Netherlands support or inhibit innovation.

5.7.1 Trade organizations

As an island with little natural resources, Japan is destined to rely on international relations. It is a member of an increasing number of international organizations to sustain and improve its international economy [25, 22]. The Netherlands is known as the Gateway to Europe and as a merchant country it is a member of a range of international co operations.

Japan

WTO

The WTO is the successor of the General Agreement on Tariffs and Trade (GATT). Japan joined the GATT in 1955 and joined the World Trade Organization in 1995 to enhance collaboration with Europe and the US in order to compete on a global market it is necessary to harmonize the economy with other players. Japan is opening its domestic market to foreign investors. Trade barriers that existed are taken down due to pressure of the WTO and the realization that free trade is an answer to global market stagnation. The rules and regulations of the organization form a common base with minimum requirements. Other regional cooperation structures will promote further development.

The United States have always been a robust and steady supporter of the world economy. Japan could rely on continuous imports and exports. Since 2001 the economy of the US and Europe took a turn for the worse and have not shown improvement since. In the last 20 years the share of global GDP of advanced industrial nations has stayed the same or has fallen while the share of East Asian markets has more than doubled. The Asian markets were expanding until the Asia currency crisis hit in 1997. In this environment the Chinese domestic market has seen a steady growth and is becoming a trustworthy supporter of the global economy. In 2002 China joined the WTO. This is a sign that the Chinese market is opening to foreign parties, which will probably result in an even further growth of the Chinese importance in world trade, very much like what happened to Japan after World War II.

The WTO could be threatened by regional trade agreements. Some cooperations such as the EU, the North American Free Trade Agreement (NAFTA) and ASEAN are growing in power as the trade between member countries increase. WTO officials recommend the regional trade agreements to move toward common trade rules, remain open to new members, avoid distorting FDIs and use WTO principles to settle disputes.

ASEAN+3

The Association of South East Asian Nations (ASEAN) consists of Brunei, Myanmar (formerly known as Burma), Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam. Japan is not an official member of the ASEAN but it is an important dialogue partner. China, South Korea and Japan are the three informal members that form the ASEAN+3 with the 'normal' members. Japan is trying to reform trade regulations by introducing multilateral free trading agreements. This is called the ASEAN Free Trade Agreement (AFTA). It is based on the WTO model which stimulates global trade and has the goal of creating a common market by the year 2008.

Over the last 20 years the manufacturing industry has been growing steadily in South East Asia. There has been a global trend towards moving production facilities to those countries. The products made in ASEAN countries however compete with each other so the intra-ASEAN trade has not grown rapidly. Because Japan is a leader in the field of high-tech development and production, but suffers from a relatively high cost of labor, Japanese companies are also moving production to other countries. The ASEAN+3 forms a platform enhancing trading relations. Another important reason for Japan to conduct business with ASEAN is the geographical location. Because distances are short is it simply cheaper to trade with ASEAN-members than with countries on the other side of the earth.

Although the Japanese economy has been stagnating for some years, the Chinese domestic market has seen a steady growth. If Japan wants to climb out of recession, the only market demand to respond to is the Chinese one. There has been a steady revolution in China that has raised the consumer spending drastically. Japanese products are especially wanted which creates a continuous demand.

It is important for Japan not to focus on excessive concentration in China. The

ASEAN countries are viewed as a whole to find a balance in international partnerships with the aid of the AFTA.

APEC

The Asia-Pacific Economic Cooperation (APEC) is a forum for facilitating economic growth, cooperation, trade and investment in the Asia-Pacific region. It was founded by Australia to improve trade relations in the Pacific region. Japan joined in 1989 and uses this cooperation to establish a strategy related to intellectual property rights protection. Counterfeiting and patent infringing by other APEC members is a growing concern and Japan is actively trying to reduce it.

In order to regain economic growth Japan must capitalize on its investments. Those investments can only be in knowledge and innovation because of the high labor costs. In that respect it differs significantly from some of the other members of the APEC, which compete on a global scale by offering low-cost labor and manufacturing possibilities. Without the agreements made in de APEC Japan will miss a great deal of merits originating from innovation.

OECD

Japan joined the OECD in 1964 and with it joined a group of 30 member countries sharing a commitment to democratic government and the market economy. Its work covers economic and social issues from macro-economics to trade, education, development, science and innovation. It works on a diplomatic level to combat fraud, introduce Corporate Social Responsibility, define standards of corporate behavior and protect human rights. The OECD officially does not create obligations but merely guidelines, a voluntary set of principles. In reality however, the organization can exert great pressure and most governments follow the recommendations.

The Netherlands

WTO

The Netherlands is one of the founding members of the GATT. The Netherlands have trade relations with countries outside the EU so one of the major ways to improve global trade relations is to promote free trade through the WTO.

EU

The European Union (EU) is the result of economic cooperation dating back to the Marshall plan of 1948. Currently the EU has 25 member countries whose shared objective is to form a trading power that can rival the United States and powerful Asian countries such as Japan. The power of the EU with respect to the individual member countries has been growing slowly but steady. The European Court of Justice even supersedes the courts of individual countries.

The EU has been very successful in promoting the internal market. It has harmonized many standards, laws and procedures resulting in an extra GDP growth of 1 to 1.5%. Reasons for this success are also the large international businesses that can treat the EU as one market and the introduction of the European currency, the Euro. Some have the dream of some day establishing the United States of Europe, but it will take a long time to reach the level of cooperation as seen in the US.

A downside of the EU is found in the term 'Fortress Europe', used by outsiders such as Japan and the US. to express the fear of exclusion from intra-European privileges. This can also be a threat to the WTO which operates on a larger scale than Europe.

Benelux

The Benelux is the cooperation of the Netherlands, Belgium and Luxemburg that was established in 1956. Goals of the Benelux are to complete the internal market, to intensify border crossing cooperation with regards to traffic, infrastructure and nature and to improve legal matters, law enforcement and immigration issues.

With the growing power of the EU it is expected that the Benelux will become less important. Some aspects however cannot be disregarded. Cooperation between the Benelux countries is much more advanced than between EU members so it can be an example and guide to Europe. Another aspect is the relative input of EU members to the whole. An alliance of three small countries will have more impact than one of twentyfive.

OECD

The Netherlands is one of the original members of the Organization for Economic Cooperation and Development.

Comparison

Both Japan and The Netherlands have sought global initiatives to improve their trade relations and have been successful in exploiting the trade advantages. The early joining of the GATT or WTO and the OECD shows that international trade organizations are vital to the economies.

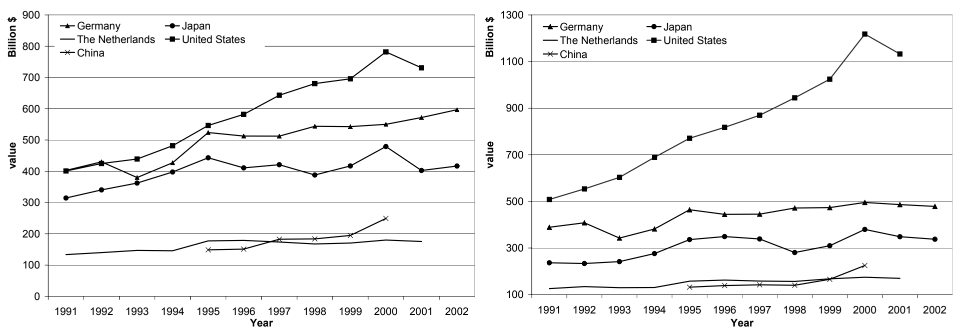
More than Japan, the Netherlands also sought local cooperation. The Netherlands is a member of the Benelux and the EU to compete on a larger scale than the size of the country would indicate. Japan is a large economy and country on its own so instead of being a member of local agreements it has invested in trade relations with local co operations as a whole.

5.7.2 Export and import

A country's international trade is collected in its export and import. The export consists of all the goods sold by domestic companies to consumers in other countries and the import consists of all the goods sold in and to Japan (or the Netherlands) by foreign companies. The statistics on the import are therefore a measure of the dependence for products and materials of a country on other countries. The statistics on the export show the industrial sectors in which the exporting country is a competitor on the world market.

Japan

The total size of Japan's import and export ranks it amongst the top five of largest international traders in the world. In 2001 it imported almost 350 million US Dollars and it exported over 400 million US Dollars. Only the United States and Germany imported and exported more [26]. It should be noted that the statistics on China are exempt from the values of the import and export conducted by Hong Kong [27], if these were to be added to the statistics on China its export and import values exceed those of Japan [28]. See figure 5.11 [26] for an overview of the values of import and export of recent years.



(a) Export value. (b) Import value.

Figure 5.11: Export and import values.

The values of the export and import are also depicted in figure 5.12. The trade balance, the difference between import and export, is reasonably stable. What can also be derived from this figure is that there is very little growth in the export and import of Japan. It seems to have reached a somewhat stable level since 1999. This holds also for the import and export levels of the Western countries. China on the other hand is still growing rapidly. There is a lot of concern about this development in Japan, because they fear that a lot of companies will leave Japan and set up their business in China. This is a real concern, because it has happened in Asia that entire industries are shipped to another country in little more than 48 hours. The Japanese government is currently working hard to reorganize their economic structure as a mean to create a more attractive environment for innovating companies to do business in.

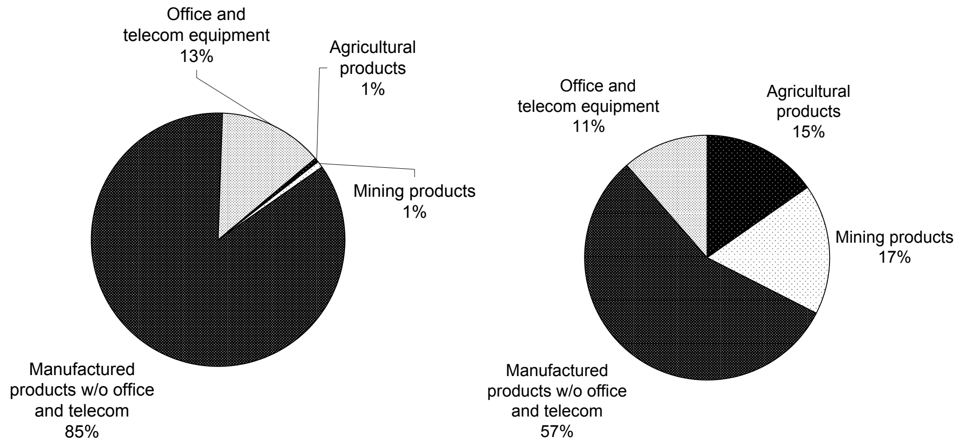
Figure 5.12: Import and exports value of Japan

Until the 1970s Japan's international trade was characterized as being vertically established, this means that raw materials were imported into Japan and finished goods were exported to other countries. After the 1970s this changed due to two oil crises and an increasingly strong Yen [13]. Nowadays Japan's international trade is more leaning towards being horizontally established, this means that both the chief import and export products are finished goods. The ratio of industrial products to total imports has increased from 20% in the decade of the 1970s to 50% in the 1980s and 60% in the 1990s, this is almost the same ratio found in the economies of Western countries. Now that Japan increased its import of finished products from abroad and relies less on domestic manufacturing than it used to, it can be said that it is also importing technology out of those countries.

Figure 5.13 [29] shows the composition of the import and export of Japan in 1999 as a percentage of total import and export. More recent information on this composition could not be found, but it was assumed that percentages are slowly changing for an internationally established economy, so that this composition is applicable to the current situation. It is clear that Japan still relies heavily on other countries for its supply of raw and basic materials, like fuel and food. The horizontally established trade system is also visible in these figures, telecom and office equipment comprises 21.8% of the total export, but it comprises also 14.2% of the import.

An important factor in the increase in imports of manufactured goods has been the expansion in the 1980s and 1990s of Japanese businesses into the nations of North America, Europe and Asia and their export of goods back to Japan, for instance VCRs and precision machinery from Europe. The sales of imported VCRs and televisions exceeded the sales of domestic models [30].

Since halfway the 1980s an increasing percentage of Japans export consisted of



(a) Composition of Japanese Export.   (b) Composition of Japanese Import.

Figure 5.13: Japanese export and import percentages per economic sector.

technology intensive products, like personal computers and telecommunication equipment. An important factor in this development is the fact that the modern generations of Japanese are really into the latest technologies and that companies who produce those products have a large domestic market for their products in Japan, which makes it more attractive to develop those products in Japan and export them to other countries.

The Netherlands

The Netherlands plays an important role in the international economy, considering the size of the country. In 2001 they imported and exported somewhat less than half of the Japanese import and export, although there live 127 million people in Japan and only 16 million people in the Netherlands. In figure 5.14 the statistic data on the import and export of the Netherlands is given for the last 10 years [29].

In figure 5.14 it can be seen that the trade balance of the Netherlands is reasonably stable as well and that the value of the import and export has also been reasonably stable in the past five years.

The composition of the Dutch export and import in 2002 is depicted in figure 5.15 [24].

As can be seen from the above figures the Dutch international trade is also horizontally established, finished products are main import and export goods. Also noted should be that the Netherlands is a 'transport hub', which means that a lot of the imported goods are immediately exported to other countries.

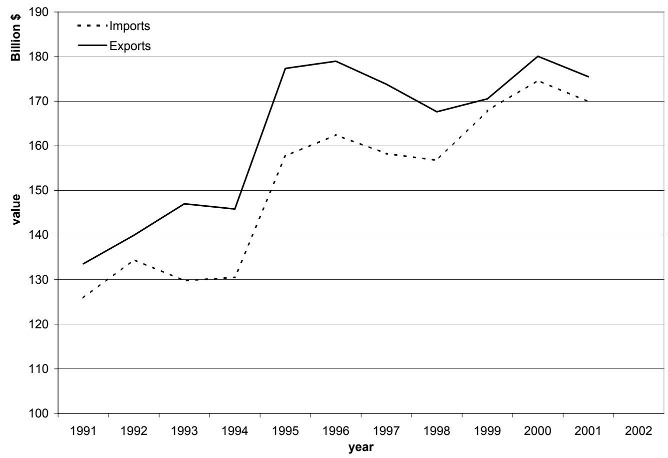
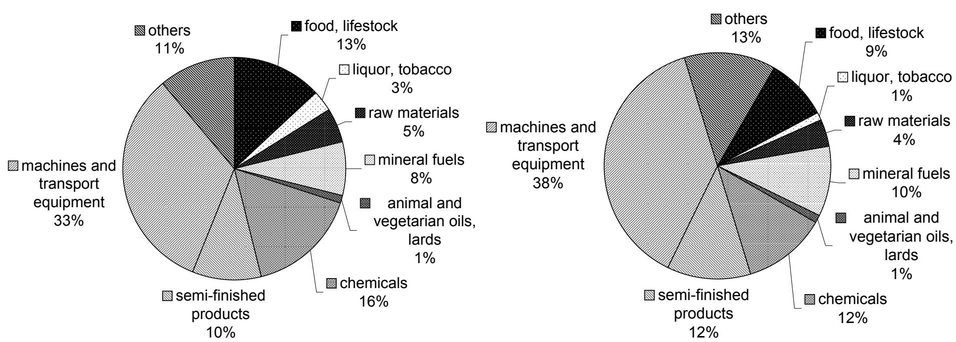


Figure 5.14: Import and export values of the Netherlands.



(a) Composition of Dutch export. (b) Composition of Dutch import.

Figure 5.15: Dutch export and import percentages per economic sector.

Comparison

The values of both the export and import are high in Japan and the Netherlands. Japan and the Netherlands both import a lot of minerals and fuels, because neither country has natural deposits that can meet their demand. The Netherlands however has natural deposits of gas and coal, which are exported to other countries. Japan is also very dependent on other countries for their food supply. Because Japan is very dense populated there is no room available for all the needed agriculture. 15% of the Japanese import consists of food supplies.

Both countries have a horizontally established economy, finished goods are the main import and export products. The import and export composition of the Netherlands and Japan are complementary, which means that they are not really heavy competitors in the global economy. This also means that they can trade very well together, which will be discussed in the next section.

5.7.3 Important trade partners

Because Japan and the Netherlands both rely heavily on international trade for their supply of goods, it is important to look on which countries they depend on for this supply and which countries rely on them for their supply of goods.

Japan

The Netherlands, China and the United States have always been important trade partners for Japan, although the trade with China diminished after World War II due to the isolation of the country by the communist regime. China is currently becoming a more important trading partner now that that country is slowly opening itself to the international community.

As can be seen in figure 5.16 [31] the US is still the main trading partner of Japan, but also the European countries and the countries of ASEAN trade a lot with Japan. In figure 5.17 [31] the historic percentages of export and import of Japan are given for North America, Asia and China. From this figure it can be seen that especially the import out of China is rapidly increasing in the last years. China is therefore becoming more and more important for Japan, as Japan is increasing its dependence on China for its supply of goods.

The Netherlands

The most important trading partners for the Netherlands are given below in figure 5.18 [24]. As can be seen from this figure, the largest part of the Dutch import and export goes to other European countries. This is a result from the 'transport hub' function that the Netherlands performs in Europe, they distribute the manufactured goods of other European countries in the rest of Europe.

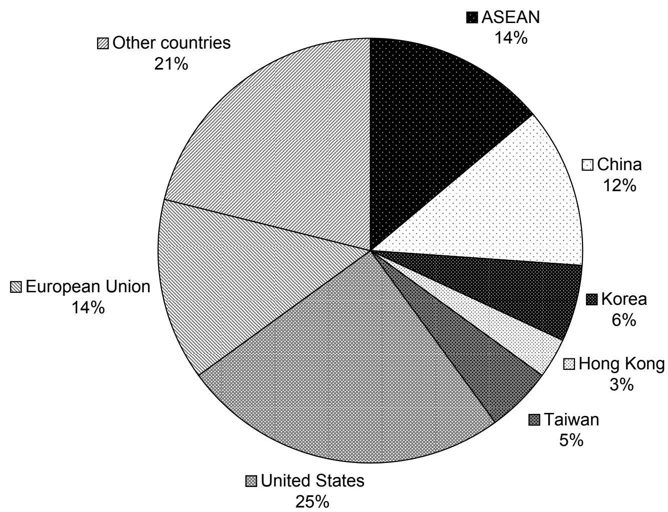
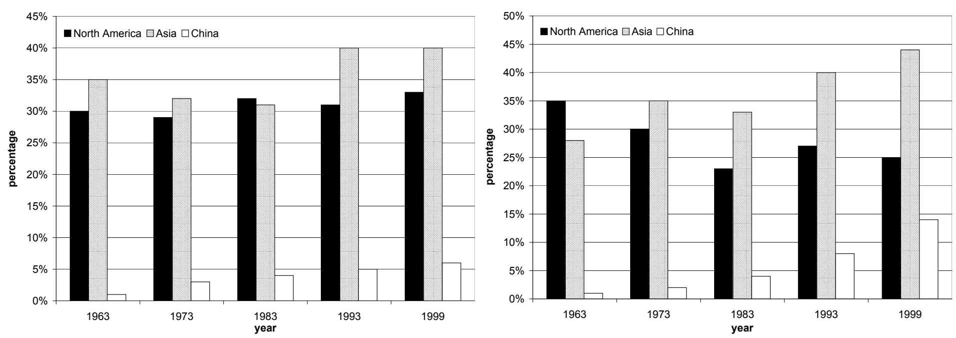


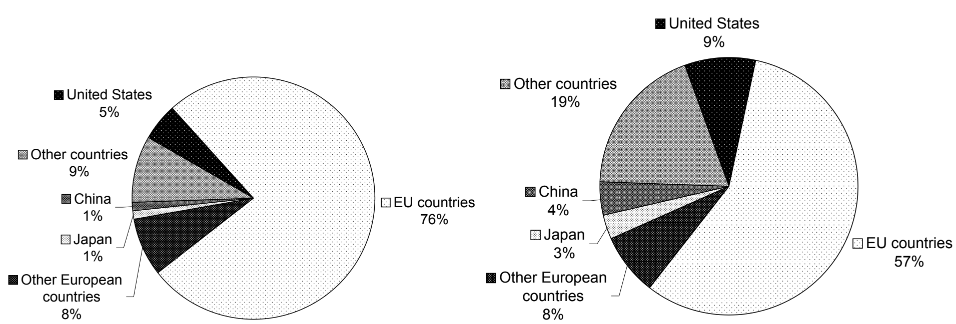
Figure 5.16: Main trading partners for Japan.



(a) Japanese export per country

(b) Japaneseimport per country

Figure 5.17: Trends in trading.



(a) Dutch Export per country.

(b) Dutch Import per country.

Figure 5.18: Import and export percentages per country.

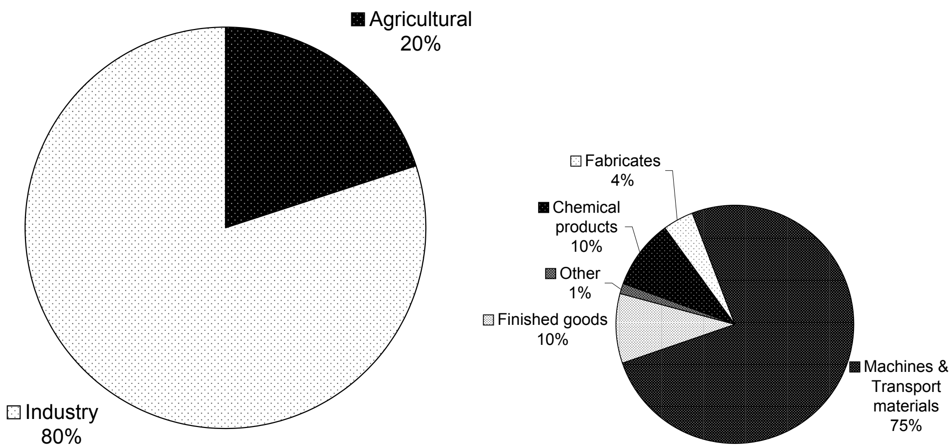
Dutch - Japanese trade

In figure 5.19 the percentages are given on the composition of the import and export of the Netherlands to Japan in 2002 [32] For a full specification of the export see [32]. The value of the total import of Japan was 6400.7 million Euro and the total export was 2363.7 million Euro. This clearly shows that the trade balances between Japan and the Netherlands show a large surplus for Japan, over 4000 million US Dollar. In table 5.4 the trade balances are given for four consecutive years, these are computed as the Dutch export to Japan minus the import out of Japan.

Year	1999	2000	2001	2002
Trade balance (million euros)	-5580,7	-6948,9	-6474	-4037

Table 5.4: Trade balances.

These trade balances clearly show that the Dutch import out of Japan is much larger than the Dutch export to Japan.



(a) Dutch export to Japan. (b) Dutch import from Japan.

Figure 5.19: Dutch - Japanese trade.

Comparison

Both Japan and the Netherlands are very active international traders. They both trade with a lot of different countries, but the majority of the trading happens with the surrounding countries. For the Netherlands this are its fellow countries in the European Union and for Japan these are the countries of ASEAN and the United States.

The Dutch - Japanese trade has shown a big surplus for Japan in the past, see table 5.4. This means that the Netherlands buys more Japanese goods than that the Japanese buy Dutch goods. This could be one of the reasons that Dutch companies are investing a lot of money in the Japanese economy. This way they could be trying to increase their sales in Japan and that would decrease the trade balance.

5.7.4 Trade barriers

Trade barriers are factors that make it more difficult for companies abroad to conduct trade in another country. There are fundamentally two types of trade barriers: government imposed and cultural imposed. The government imposed trade barriers can be divided into formal and informal barriers [33]. Formal trade barriers are direct measures to impede trade and informal barriers impede trade, but are otherwise promoted. Examples of formal barriers are quotas and tariffs. Various distribution laws can be examples of informal barriers.

Japan

Japan has the fewest formal trade barriers of all the countries in the world [30]. This situation arose under pressure from the United States and the voluntary removal of such restrictions by the Japanese government. The United States wanted those barriers to be removed so its companies could export more freely to Japan and the Japanese government tries to attract more foreign investors to Japan this way.

Although there are almost no formal trade barriers like quotas [34], foreign companies, especially US companies, have found it in past years sometimes to be difficult to export to Japan. The implementation of certain Japanese laws namely prohibited the sale of foreign products. Two recent examples of trade conflicts arising due to Japanese lawgiving are the Large-Scale Retail Store Law and Fruit Varietals [35].

The trade conflict on Fruit Varietals was a complaint filed by the United States with the WTO in October 1997. Japan prohibited the import of fresh apricots, cherries, plums, etc. from the continental United States, because these fruits potentially hosted the coddling moth. The WTO ruled in favor of the United States. There were three causes for this ruling. Japan had maintained the same quarantine provisions for the fruit varieties and had not identified the risk specifically enough. Japan had used more trade-restrictive varietals testing requirements than were necessary and Japan had failed to publish its testing requirements.

The Large-Scale Retail Store Law, in place since 1974, was designed to protect smaller shops by restricting the operations of retail giants located close to the weaker players [36]. Toys’R’us for example, a US retail toy chain, found itself unable to obtain access to the Japanese toy market. Under pressure from the United States this law has been replaced by a new law in 2000 [30]. This new law focuses more on issues like the impact a large store has on the environment, embodying the shift of policy emphasis from regulation to ‘coexistence’ [36].

This is a trend that is visible in the entire economy of Japan. The Japanese government has started to deregulate many sectors of the economy as a mean to create a new driving force for economic growth [37].

Cultural imposed trade barriers are more difficult to point out, because they are not written down anywhere, but are visible in the manner in which trade is conducted. Cultural differences can make it difficult for companies from other countries to do business in Japan. For instance, Japanese are averse to risk. As such this is also reflected in their manner of trade. If, in a Japanese business deal, you are unable to back your promises and obligations up by an internationally well known decent reputation, it is most unlikely that you will be able to do business with major Japanese companies. Therefore Japan is also known as a land of no second chances, because if you are unable to fulfill those obligations you will most likely not be able to find another Japanese partner [38].

The Netherlands

The Dutch have a long tradition of free trade and this translates itself into their economy. The market economy of the Netherlands is very open and foreign companies receive a nondiscriminatory treatment [39]. Investment subsidies and subsidies to stimulate research and development, to encourage the development and use of new technologies by small and medium sized firms, are also available to foreign companies and investors.

No formal trade barriers exist, but there are several informal trade barriers. These barriers however result from common EU policies. Several examples of these barriers are standards and certification requirements, product approvals and some trade preferences given to specific countries. The Dutch government does impose offsets for defense contracts, this means that the foreign seller has to purchase Dutch goods or permit domestic companies to parts of the systems it is buying [40].

The largest trade conflict with the United States arises over pharmaceuticals [39]. US companies have complained that the criteria used by the Dutch Health Insurance Board too often result in their new-to-market products being incorrectly classified with compounds determined by the board as "therapeutically equivalent" than as "unique, innovative compounds". This results in a lower international reference price. They have also voice concerns that the Board procedures result in considerable and unnecessary delays in their introduction on the Dutch market.

International trading has been an integral part of Dutch society ever since the founding of the V.O.C. [41]. Because trade is part of the Dutch culture, there are no culturally imposed trade barriers.

Comparison

There are not many formal trade barriers in Japan and the Netherlands. There have been more complaints about informal trade barriers existing in Japan than there were about the Netherlands. The Japanese government has been and is reorganizing its economy to remove unfair impediments to international trade.

On a cultural level it is easier to trade with the Dutch than it is to trade with the Japanese. This because Japanese are very risk averse and they are a somewhat less open country to foreigners than the Netherlands.

5.7.5 Foreign Direct Investments (FDI)

In the international economy it is useful and sometimes even necessary for internationally operating companies to make investments in other countries. Benefits can be amongst others the direct access to knowledge present in that country, cheaper labor costs and a boost of sales in that country. A good example of the latter are trade agreements in which quotas are eliminated if part of the production process takes place in that country [35].

Japan

After World War II the involvement of Japanese companies in overseas companies centered on the export of goods. Since the 1980s however direct investments in overseas countries began to grow. Reasons for this were amongst others the shift to overseas production due to trade friction, for instance the North American automobile market. Because of the strong Yen, particularly electric and electronic goods manufacturers moved to South East Asia and China in search of high-quality, low-cost labor. These companies also shifted their production to China and Southeast Asia in order to develop markets where there would be potential for major increases in demand. Figure 5.20 [31] shows an overview of the overseas direct investments made by Japan.

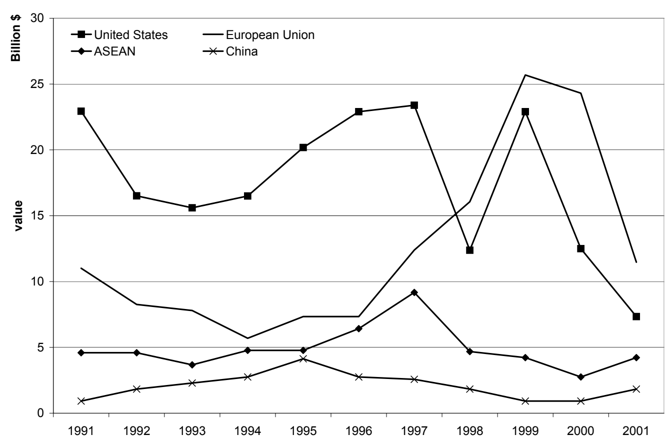


Figure 5.20: FDI by Japan.

Figure 5.21 [21] shows the foreign direct investments made in Japan in 2001. In this year companies from the Netherlands were the largest investors in Japan, with a combined investment of 2.3 billion US Dollar.

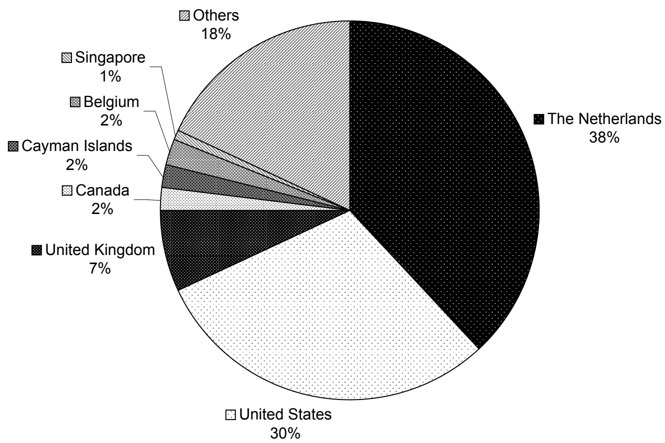


Figure 5.21: FDI in Japan.

Figure 5.21 [21] clearly shows that although the investments in Asian countries started to grow early in the 1990s, the investments in Europe and the US are still considerably higher. Japanese companies are investing the most in European countries since 1998. The total overseas investments dramatically declined in 2000, which coincides with a decrease of 80 million US Dollar in the export of Japan and a 30 million US Dollar decrease in the import, which are ascribed to three factors [42]. These factors were a too large dependence on foreign demand for the Japanese products, a failure to increase domestic consumption and third the non-performing loans and excessive outstanding debt.

The Netherlands

Table 5.5 [43] shows the FDI made by foreign companies in the Netherlands and the FDI made by Dutch companies in foreign countries. As can be seen from this table, companies in the Netherlands invest the most in other European countries and also the largest FDI in the Netherlands are made by European countries.

FDI by The Netherlands (in billion euros)		FDI in The Netherlands (in billion euros)	
E.U.	15,24	E.U.	15,45
Japan	-0,14	Japan	0,99
United States	3,39	United States	-3,33
Eastern-Europe	2,94	Other European countries	1,04
Other countries	6,19	Other countries	2,71
Total	27,62	Total	16,86

Table 5.5: FDI of the Netherlands.

Comparison

The FDI in the Netherlands are high compared to that in Japan, almost three times as much. In the Netherlands the EU is the main sponsor while in Japan the US plays the most important role. The FDI made by Japanese countries is almost the same in value as by Dutch companies, but the Dutch economy is a lot smaller than that of Japan. This contributes to the higher competitiveness ranking of the Netherlands, to be seen in the next section.

5.7.6 International economic indexes

The international economies of the world can be compared and indexed by several methods. Each method focuses on certain aspects of those economies. In this chapter, two of those indexes are examined.

Competitiveness

The IMD, a business school in Switzerland, publishes a yearly competitiveness ranking. In this ranking the economies of 60 countries are analyzed on the ability of nations to create and maintain an environment in which enterprises can compete [44]. The methodology of this ranking [44] comprises of the comparison of the participating economies on over 300 different factors. These factors can be divided into four groups: Economic Performance, Government Efficiency, Business Efficiency and Infrastructure.

In table 5.6 the ranking from 2000 to 2004 of several countries is depicted.

Country	2000	2001	2002	2003	2004
United States	1	1	1	1	1
Japan	21	23	27	25	23
United Kingdom	15	17	16	19	22
The Netherlands	4	6	4	13	15
Australia	11	12	10	7	4
Germany	13	13	17	20	21
Malaysia	26	28	24	21	16
Taiwan	17	16	20	17	12

Table 5.6: Competitiveness ranking.

Technology rate

The technology rate gives the percentage of high-technology products in the total manufactured exports. In other words it measures the dependence of the exporting country on high technology. In table 5.7 the technology rates and their ranking on the world chart of 2000 are given for several countries.

Comparison

Above indexes show that both Japan and the Netherlands are very advanced and developed countries, although the Netherlands ranks on both indexes a bit

Country	Technology rate 2000	World ranking 2000
United States	34%	9
Japan	28%	13
United Kingdom	32%	11
The Netherlands	35%	7
Australia	15%	31
Germany	18%	26
Malaysia (1999)	59%	4
China	19%	24

Table 5.7: Technology rates.

higher. Japan has remained steady around rank 23 on the competitiveness index for the past five years, the Netherlands however ranked on the fourth place until 2003. Then they fell back to the 13th place. This means that the Dutch economy has become less competitive in comparison with the Japanese economy, but still outranks it.

Both countries have a high technology rate, which clearly demonstrates a dependence on technology intensive products. Therefore innovation is necessary to sustain the status quo, because only by producing innovating products it can be assured that foreign countries will keep on buying those products and thus the ability to export them.

5.7.7 Conclusion

Japan and the Netherlands are both countries that have a large international trading economy. Both use trade organizations to improve free trade on a regional and global scale. Japan as an island is isolated and this is reflected in the difficulty of foreign companies to get access to the Japanese market. The official trade barriers in the form of tariffs have been taken down, although many trade barriers exist on the cultural level and through local laws. The Japanese government has also began to take down the latter. The relatively small amount of FDI in Japan is a sign that foreign companies still have difficulties gaining access to the Japanese economy.

Both Japan and the Netherlands experience recession, but the Japanese recession has been lasting for more than a decade while the Dutch recession started a few years ago. The Japanese and the Dutch economy have shown signs of improvement, but it is not clear if the recent economic growth will continue.

Although the GDP of Japan is more than ten times higher than that of the Netherlands, the imports and exports of the Netherlands are still half of that of Japan. Both countries have a trading surplus. The FDIs of both countries are comparable in size, but Japan has mainly investments abroad while the direct investments in and out of the Netherlands are balanced.

Technology and innovation are very important to both economies. The shares of exports that are technologically intensive are about one third for both, but Japan invests more into research and development than the Netherlands does.

	Japan	The Netherlands
Historical economic strength	International trade	International trade
Regional trade organization	Dialogue partner	Founding member
Global trade organizations	Member	Founding member
Trade barriers	Cultural & Informal	Few
Current economical situation	Long period of recession	Short period of recession
Economic outlook	Optimistic: Growth	Pessimistic: Stagnation
GDP (2001)	4175 billion $	384 billion $
GDP per capita (2001)	$ 32.809	$ 24.029
Imports (2001)	349 billion $	195 billion $
Exports (2001)	404 billion $	216 billion $
Main trading partner	United States	Germany
FDI in country	6 billion $ (2001)	17 billion € (2003)
FDI by country	36 billion $ (2001)	28 billion € (2003)
Competitiveness rank (2004)	23	15
Technology rate (2000)	28%	35%
% of GDP in R&D in (2001)	2.8%	2%

Table 5.8: Comparison table on national economy

In this paper an overview of the international economies and their operation has been given. Now it is necessary to answer the main research question:

> *What are important economic forces that support or inhibit innovation at the international level?*

A supporting factor for innovation is a lot of trade with many different countries. This improves the delegation of knowledge from those countries to your country. Another supporting factor are the Foreign Direct Investments (FDI). FDIs also let companies acquire new knowledge from other countries, which they can use in their innovating process.

Inhibiting forces in international economies are trade barriers and recession. Trade barriers inhibit the flow of innovating products and technologies from one country to another. Recession has a similar effect, but now the cause is the declining spending power of countries. They are simply not capable to buy and acquire the innovating goods and technologies.

5.8 National economy

by Michel van Dijk, Rogier Veenhuis, Matthijs Krens and Harald Profijt

This chapter describes the macro level national economic research for an answer to the following question:

> *What are important economic forces that support or inhibit innovation at the national level?*

To answer this question, a macro research with respect to the national environment of the Japanese industry has to be carried out. With the information found, we look at the forces acting on the innovation.

It is useful to split up the economic aspect in the following factors:

- Business cycles;
- GNP trends;
- Interest rates;
- Money supply;
- Inflation;
- Unemployment;
- Income;
- Energy.

To obtain a clear image of the economic situation at macro level in Japan, information about the Japanese situation has been collected. Information about the Dutch situation has been collected as well, because it is very useful to make a comparison between both countries. In this, section the above mentioned important factors will be discussed.

After the discussion of the factors, conclusions can be drawn about the Japanese national economy. This results in a clear answer to the research question stated above.

5.8.1 Business cycles

Business cycles are more or less regular patterns in fluctuations of macroeconomic variables, such as output, unemployment, consumption, prices or interest rates. A more sophisticated definition is given by Burns and Mitchell: "Business cycles are a type of fluctuations found in the aggregate economic activity of nations that organize their work mainly in business enterprizes: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten to twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own." So, a business cycle consists of a peak in economic activity, a contraction followed by a trough, and an expansion. Figure 5.22 shows a stylized example.

A business cycle is not a real economic variable but more an analyzing tool which looks at the past of a macro-economic variable to make some prediction about the near future. Therefore it does not effect innovation, or any other thing, directly. It only states that when for example the GNP has dropped in the last few years and is now stabilizing, it is likely that it will become really stable and after that will begin to go up again. This also works the other way around of course.

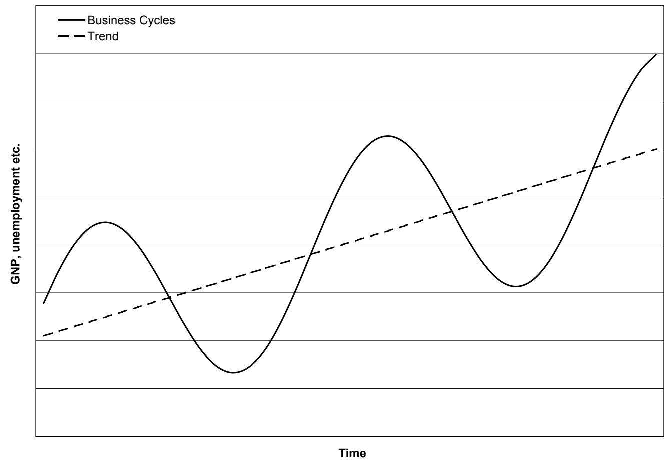


Figure 5.22: Business cycles.

Japan

In the Japanese economy most of the macro-economic variables are on the rise, although slowly, since the dramatic downfall in the nineties. With the theory of the business cycles we would expect the economy to grow until it is higher than it was before. Of course this may take a long time and with the huge length difference in business cycles it may even envelope some smaller peaks and trough but eventually it will get back to were it was. For the very near future there will be no economics growth since Japan is just starting to work on some major changes in its economic system and these changes are very hard to realize. But in the long run Japan will make a large climb in economic growth, the growth in employment and the other variables, and those will be mostly growing in the future.

The Netherlands

In the Netherlands the economy and other variables have just begun showing some growth. This would mean that we are on the beginning of an expansion period. Since growth will stimulate innovation we think that in the Netherlands there will also be opportunities to innovate. Only since this is the beginning of the expansion people will be a bit cautious and this will inhibit innovation for just a short while longer.

Comparison

What we see is that Japan has suffered from a collapse in the economy in 1990 and it has taken ten years to get a very limited growth again, while the global economy went down, causing another drop. Japan is starting to go through some organisational changes which should get Japans economy on the rise again. The Netherlands has almost overcome the global recession and the economy is growing again. The course of business cycles makes us believe that its influence on innovation will be beneficial in the Netherlands soon, and in Japan it is not beneficial yet but it will become so in the future.

5.8.2 GNP and GDP trends

The most important fact of the economic situation in a country is the size of its economy. The size of an economy is usually expressed as GNP (Gross National Product) but sometimes the GDP (Gross Domestic Product) is used. These two indicators are closely related to each other. The GNP considers the produced value by a country, whereas the GDP considers the produced value within the borders of that country, regardless of who owns the productive assets in the country. This definition implies that the size of an economy is the amount of production that takes place in a country. In a balanced situation this amount of production is equal to the amount of consumption. When consumption is larger than production this is called overspending, the opposite situation is also possible. Then production is larger than consumption which leads to an increase of the supplies of the companies.

In general GNP/GDP are dynamic values. To improve welfare in a country it is needed that GNP/GDP grow steadily. This means that more goods can be bought and this generally leads to an increase in welfare. Even a stable GNP/GDP may not be enough to keep the welfare at the same level. This is because competing countries keep on improving their products, thereby gaining competitive advantage.

Japan

After World War II, the Japanese economy was devastated. Because of the many air raids and bombing production facilities and factories were demolished. The US helped Japan rebuilding their economy by investing large amounts of money. This was mainly done because the Americans feared that communism would come to Japan if it was not economically re-established. The Japanese economy has been growing at a percentage of almost 5% per year from 1965 to 1990. Such growth is exceptionally large and even today economists and scientists still try to understand how this can have happened.

In the early nineties a so called bubble economy has developed. This bubble burst and stock prices raced down to only a third of the values they topped at. The nineties showed a period of economic recession, which means a decrease of GNP/GDP. The Japanese government has spent enormous amounts of money in order to prevent a total collapse of the economy, but this has not yielded any spectacular results.

The last four years the GNP is growing with an average 1% per year. This means

	1995	1998	2000	2001
Japan	5291	5512	5680	5642
United States	7338	8285	8968	9083
Germany	2458	2560	2686	2702
EU-15	8613	9230	9785	9941

Table 5.9: GDPs (in billion US Dollar, at 1995 prices and rates)

that at least there is some growth but it is very small. Predictions for upcoming years do not see a change in this situation in the very near future.

Table 5.9 gives an overview of the GDP of Japan, the United States, Germany and the EU15.

The Netherlands

In the Netherlands the GNP has been growing rapidly from 1990 until 1999 but in the year 2002 the growth stabilized and in 2003 it even declined. Figure 5.23 gives an overview of the Dutch GNP growth rates.

Figure 5.23: GNP growth in the Netherlands.

The first decline was just after the Asian economies collapsed and the decline in 2001 was caused by the decline in the global economy. The first quarter of 2004 showed a growth of the economy and it is hoped that this will continue, however this is not a certainty at the moment.

Comparison

Both Japan and the Netherlands are currently in a situation of minimal growth but Japan has been at this level for quite a long time. The people and companies will probably be more hesitant to jump in and start big investment or otherwise considerable risks. Therefore this is a factor that in both countries currently inhibits innovation but probably do less so in the Netherlands compared to Japan.

5.8.3 Interest rates

An important instrument a government can use to exercise its influence on the economy is the interest rate. Usually when an economy is doing well interest rates are relatively high. This stimulates consumers to save money which in turn can be lent to companies which use the money for investments. If consumers keep on spending money, flourishing economy can rise to fast and get out of hand before coming to crash. This is exactly what happened in Japan in the early nineties. Economy was flourishing and an interest raise came too late resulting in a bubble economy that finally burst. On the other hand, if the economic situation in a country demands to be stimulated, interest rates are kept low. This makes saving money less attractive so consumers will spend more money. This stimulates the production of goods and should help to get the economy running.

Japan

In Japan interest rates have been virtually zero for several years now. Still the expected consumption did not happen. This is partly because of deflation (the same money can buy more later) and partly because the Japanese are used to save money. This is because they want to be guaranteed of income for later and the current uncertain economy keeps them from spending their money.

The Netherlands

In the Netherlands currently the interest rates are also on a relative low level, because the Netherlands also suffers from a bad economic situation. The level of interest rates is not as low as it is in Japan, though. The low interest rates here however are more effective in making the country's economy start climbing out of the mud.

Comparison

The interest levels in both Japan and the Netherlands are relatively low. This is a method to boost consumption and it makes it cheaper for companies to invest. So this is a factor that stimulates innovation in both countries.

5.8.4 Money supply

The money supply of a country is the amount of money that can circulate through the economy freely. It is also called the money stock. In the money supply there are usually 3 indices being used: M1, M2+CD and M3+CD.

M1 is the cash currently in circulation and the deposit money, or the paper bills and coins plus the money people and companies have on their bank account. This is the indicator for the so called high liquidity. M2+CD includes M1 and also adds the quasi money and Current Deposits (CDs) to the index. The quasi money consists of time deposits, deferred savings, instalment savings and foreign currency deposits. Most of these are deposits which do not allow immediate withdrawal but after the termination date are converted directly to cash currency or deposit money. The CDs are current deposits held by domestically licensed banks. This indicator is often called the representative liquidity because it holds all the money which has a reasonable influence on the economy. M3+CD includes M2 and similar items to M2 as money thrust, post office deposits and credits for agricultural and fisheries cooperatives etcetera. Japan and other Asian countries also have an index called broadly defined liquidity which includes absolutely everything, even government and foreign bonds. This index is not used in European and American money stock statistics.

Japan

Figure 5.24 shows the development of the Japanese money supply from 1998 up to now.

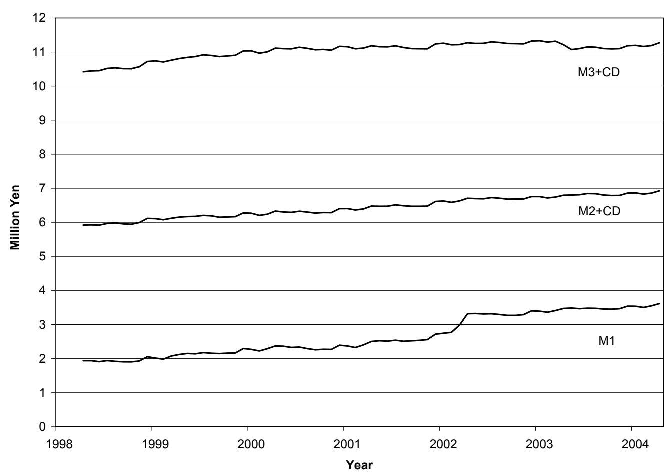


Figure 5.24: Money supply for Japan.

As we can see there is a reasonably steady growth in the money supply. This growth has been obtained by the constant devaluation of the Yen. This is deliberately caused by the Bank of Japan in order to get the Japanese economy out of the decrease and into a growing economy again. The idea behind this strategy is that of the Keynesian economic school. They believe that an increased money supply can lead to increased employment and output. This is exactly what the Japanese economy needs. An alternative economic school claims a different effect. This school is called Monetarism. This school claims that a larger money supply will only work on the short term and eventually will only lead to inflation and no increase in employment or output. This also would be a positive effect since Japans currently has deflation which causes people to save there money. So Japan should try to get a small inflation again instead of deflation

The Netherlands

Data from the European Central Bank shows that for the past 5 years they have tried to keep the growth of the M3 index around 4.5%. This is because higher growth would cause more inflation. The last 2 years however a number of countries including the Netherlands failed to maintain this and were more around 9%. When we look at Japans M3 index this figure has not been near the 5% in the last 5 years at least.

Comparison

What we see when looking at both country's money supply and the money supply growth we see that the countries have different attitudes towards the money supply and its function. Japan tries to get more growth, while the Netherlands tries to minimize growth. We can conclude that Japan is creating growth to increase employment and production and also to counter the current deflation. Therefore the money supply in Japan is a factor that stimulates the economy and hence will also facilitate innovation. For the Netherlands on the other hand the current situation is that we are failing to keeps the money supply growth at a low enough level undoubtedly causing more inflation than we would like. Therefore it is concluded that in the Netherlands the money supply is a factor inhibiting innovation.

5.8.5 Inflation

Because of the continuous rising of prices the value of money becomes less as time evolves. This phenomenon is called inflation. Usually a government tries to keep inflation low in order to presume spending power and international competitiveness. The opposite situation can occur as well. Because of a drop in prices the same amount of money has more value later. This is a negative inflation, also called deflation.

Japan

The last few years Japan suffers from deflation. The deflation keeps the Japanese from spending money, thereby slowing down economic development. To overcome this problem, Japanese government has brought more money into circulation in order to enforce inflation. So instead of trying to limit inflation, they try to stimulate it.

Year	1998	1999	2000	2001	2002	2003
Unemployment rate (%)	4,1	4,7	4,7	5,0	5,4	5,3

Table 5.10: Unemployment rate for Japan.

The Netherlands

The last few years in the Netherlands have shown inflation of approximately 3% and in the year of the introduction of the Euro even 4 or 5%. Here the government is busy trying to limit inflation by limiting money growth and stimulating consumption.

Comparison

Japan and the Netherlands are on completely different places concerning inflation but for the sake of innovation both situations are not positive. The ideal situation would be a small inflation and both countries do not have this. Therefore innovation is inhibited by this factor, in both countries.

5.8.6 Unemployment

Unemployment is defined as an economic condition marked by the fact that individuals actively seeking jobs remain unhired. Unemployment is expressed as a percentage of the total available work force (the total number of people employed or seeking employment in a country or region). The level of unemployment varies with economic conditions and other circumstances.

Japan

The unemployment figures of Japan in the past 6 years can be found in table 5.10.

It is clear that there has a rise in unemployment in the past 6 years. In 2003 there was a small decrease with respect to the year before. The increasing unemployment rate in the past 6 years can also be seen in figure 5.25. This is a complete chart from 1960 till 2002 of the unemployment rate in Japan.

The unemployment rate, the percentage of unemployed people to the total work force, was in the range between 1.0 and 2.0 percent, during Japan’s high-growth period in the 1960s. Employment conditions deteriorated after the first oil crisis in 1973. This caused an increasing unemployment rate to over 2 percent in the latter half of the 1970s and to almost 3 percent in the latter half of the 1980s. In 1990 till 1991, the rate settled down again to just over 2 percent, but it began another gradual rise from 2.2 percent in 1992. This trend has continued until the year 2002.

In 2002, there were 3.59 million unemployed people in Japan, representing an increase of 190,000 people over the previous year. It was the fourth straight year

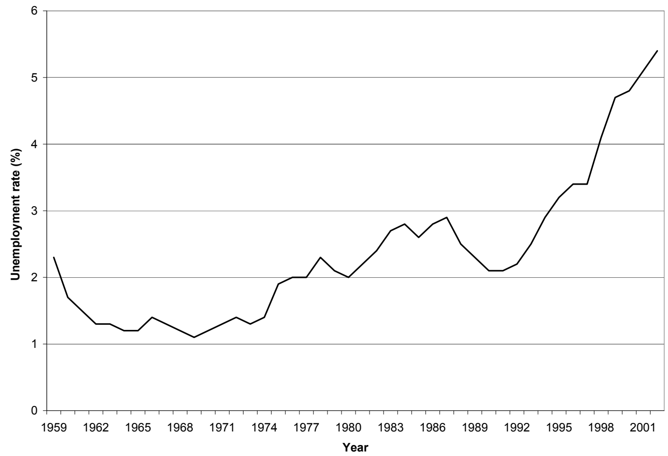


Figure 5.25: Unemployment rate for Japan.

that the number of unemployment exceeded 3 million. The unemployment rate has reached a historic high at 5.4 percent, averaging 5.5 percent for men and 5.1 percent for women. These numbers are all-time highs for both men and women, since records were started in 1953. Looking at supply and demand in the labour market, the ratio of job offers to job seekers was 0.54 in 2002. This was a decline of 0.05 point from the 0.59 recorded in the previous year.

Of the 3.59 million unemployed people recorded in 2002, 1.51 million persons were involuntarily dismissed because of payroll cutbacks, poor business conditions, mandatory retirement, and other reasons. Another 1.15 million voluntarily left their jobs for personal or family reasons. The number of new job seekers who have just graduated from schools was 180,000, while that of new job seekers for other reasons was 700,000. Viewed in terms of age, the unemployment rate for both men and women in 2002 was highest among young people aged 15 through 24 (men, 11.1 percent; women, 8.7 percent), more than twice the rate of ten years ago. One of the reasons for the high unemployment rate among young people is that the number of young people who voluntarily quit their jobs is increasing. This is due to the difficulty that young graduates experience in finding satisfactory jobs in extremely harsh employment environment where there are a limited number of employment opportunities available. Unemployment among men aged 60 through 64 was 9.7 percent in 2002. Older workers who have been forced to leave the job before the normal retirement age as part of corporate restructuring programs are finding it extremely difficult to find the next job. Among those older than the retirement age of 60, there is a growing mismatch between their strong desire to work and the available employment opportunities. The same conditions apply to women aged 25 through 34 (7.3 percent) who are seeking to re-enter the work force.

Many people over the age of 45 are finding that they do not fit into the age

Year	1998	1999	2000	2001	2002	2003
Unemployment rate (%)	4,1	3,1	2,6	2,0	2,3	3,4

Table 5.11: Unemployment rate for the Netherlands.

brackets being sought by potential employers. The search period tends to become longer for older people. Since 1995, the proportion of people looking for work for more than one year has climbed. In 2002, approximately 1.05 million people, or about 29 percent of the unemployed, found themselves out of work for a year or more.

Factors that continue to contribute to the high unemployment rate include continuing downturn of the economy and the widening gap between the demand and supply of the labour market. Three possible reasons for this gap can be given: the mismatch of labour skills, inefficient information and the preference of workers and of companies. In addition, in the past, many of the unemployed joined the non-working population when the labour market conditions became unfavourable which helped to keep the unemployment rate from rising. This restrained the rise in unemployment rate. Nowadays, the majority of those who lose their jobs tend to search for employment and, as a consequence, the unemployment rates tend to rise.

Higher labour costs, Yen appreciation resulting in the outsourcing of production facilities and growing computerization all point to a long-term structural increase in Japan’s jobless also. Due to heavy losses in labour-intensive sectors, companies are planning further outsourcing of their production facilities to countries where labour costs are much lower.

Social drama

The increasing unemployment rate in Japan causes a lot of problems. One distinct problem in this connection is a sharp increase in the number of suicide related to problems experienced by workers such as the higher unemployment rate and increasing stress. According to the National Police Agency, 31,157 people killed themselves in 2000, which was the third straight year with more than 30 thousand suicides. There are many emergency calls from families that lost their breadwinners. Many of them point out that their breadwinners’ deaths were caused by corporate restructuring or pressure being brought on workers for early retirement. It is found that the number of suicide per 100 thousand people is increasing in parallel with the rise in the unemployment rate.

The Netherlands

The unemployment figures of the Netherlands in the past 6 years can be found in table 5.11.

As can be seen in the table, there has been an increase of the unemployment in the past 2 years. Before 2002, there has only been a decrease of the unemployment. In figure 5.26 can also be seen that there is a decrease in unemployment since 1995.

Figure 5.26: Unemployment rate for the Netherlands.

From 1986 till 2003 there is a decreasing trend in the unemployment rate. In 1986, the unemployment rate was very high. It was almost 12 percent. After 1987 there was a significant decrease, but this decrease came to an end in 1992. In the second half of the nineties, the economical conditions were much better and the unemployment rate was continuously decreasing. After 2001, the unemployment rate was increasing. At the moment it is rising.

Comparison

Figure 5.27 contains the unemployment rates of Japan and the Netherlands from 1986 till 2003. The unemployment rate of the Netherlands is much more fluctuating than the unemployment rate of Japan, which has a steady rising trend. In the past 6 years, Japan has more unemployment that the Netherlands.

It is obvious that the unemployment rate of Japan from 1986 till 1998 was much lower than the unemployment rate of the Netherlands. After 1998 the unemployment in Japan has been increasing and is higher than the unemployment rate of the Netherlands. Both countries are coping with an increasing unemployment at the moment and there are no signals that it will be decreasing in the near future.

5.8.7 Income

Income is measured as the value of an economy's gross domestic product (adjusted for inflation and converted to US Dollar) divided by its population. Income or "per capita GDP" reflects hypothetical differences in the standard of living between

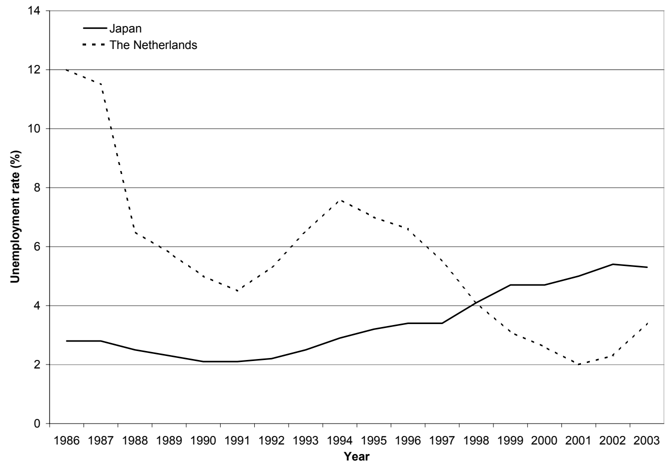


Figure 5.27: Comparison unemployment rates Japan and the Netherlands.

two economies. However, this indicator does not tell us whether wealth is evenly distributed. A high value here does not mean that every individual is doing well.

Japan

The income figures per capita of the last 25 years can be found in figure 5.28. The figures are in US Dollar so it is possible to compare these figures with the income per capita in the Netherlands.

Figure 5.28: Income Japan per capita.

There is a rising trend in the income per capita in Japan. But since 1995 with a top value of 42105 US Dollar, the income per capita is decreasing.

The Netherlands

The figures of the income per capita in the Netherlands are placed in figure 5.29.

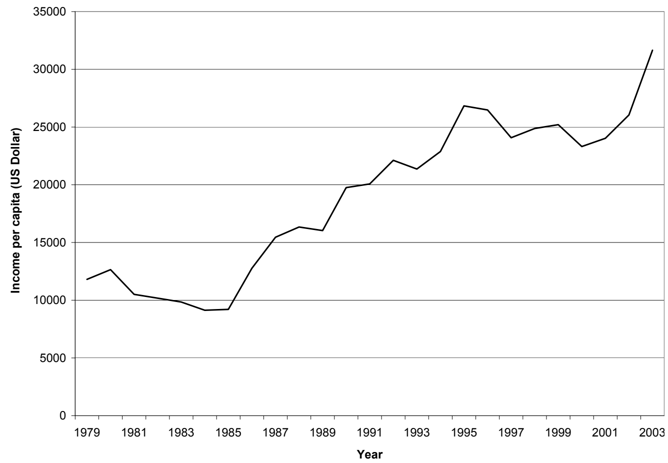


Figure 5.29: Income the Netherlands per capita.

In the Netherlands there is also a rising trend in the income per capita. The last years there has been a significant increase in the income per capita.

Comparison

To compare the income of Japan and the Netherlands it is useful to place both charts in one single chart, which is done in figure 5.30. From 1979 till 1986 the income per capita was nearly the same in Japan and The Netherlands. But since 1986 Japan has had a higher income per capita. Last year the income per capita was almost the same in Japan and the Netherlands. The overall trend is nearly the same, but Japan has a higher income per capita.

In the last 20 years, Japan had a higher income per capita. But the trend of both lines is nearly the same. Living in Japan is more expensive than in The Netherlands so it is logical that the income per capita is higher than in The Netherlands. The unemployment rate in Japan and The Netherlands is continuously increasing so the income per capita is not expected to increase much in the next years.

5.8.8 Energy

Japan

Japan has the number one electric generation ability of the world with 226 million kilowatt in 1999. With an energy consumption of 964.2 billion kilowatt hours a year they are the number three of the world after the United States and China. After the rise of the oil prices in the 1970s, Japan chose nuclear power as an

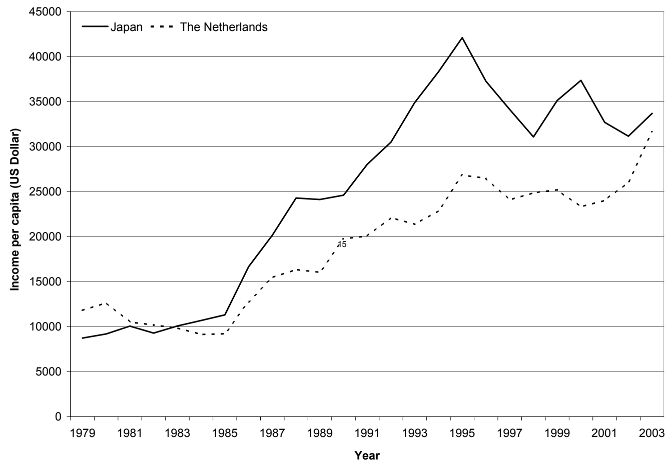


Figure 5.30: Income Japan and The Netherlands per capita.

alternative source of energy, in adversary to the public opinion. Nowadays the country is very dependent on nuclear energy (29,8%). Because all energy producers are private, they have their own policies, which has led to various crises. The largest energy producer of the world is Tokyo Electric Power (Tepco), a company that uses tens of nuclear power generators. A few years ago Tepco had to close seventeen of their nuclear stations for trespassing several security regulations. To really avoid problems several large companies were already suggested to move shifts to weekends and nights to spread the capacity. Japan should import more gas, coal and oil as a backup. It is predicted that the worldwide oil-import would rise with 30 percent if Japan should close their 53 nuclear stations. Because energy availability is becoming a world wide problem, Japan, the US, China, France and South Korea planned to build a huge nuclear fusion reactor. Main advances are the price of the freed energy and the main by-product: water.

Pollution control technologies always have played a big role in political Japan, every year 4 billion US Dollar is spent in environmental technologies. The large increase of the chemical and nuclear industry, road transport and energy transportation in the last twenty years, went faster than the technology that has to deal with its pollution. Since years air pollution is the largest problem, it has spoiled open waters and causes acid rain. Although China causes about 30 percent of the acids in the air above Japan, the Japanese government tries to regulate the increase by rules and taxes. The main goal of every environmental program is an increase of efficiency and a smaller dependence to oil so a decrease in carbon emission will be gained. Using taxes and scientific research, Japan's Ministry of International Trade and Industry (MITI) wants to maintain Japan's position as leader in energy-efficiency. The research program mainly contains the following components:

- Re-usable energy sources;

- Fossil energy sources;
- Transportation of energy;
- Conservation of energy;
- Mineral sources;
- Securing stable energy supply;
- Promotion of energy-efficiency;
- Administering the electric power and other energy industries.

In several projects MITI cooperates with The Energy Conservation Center, an allegiance of several large energy-consuming companies in Japan. At the moment Japan Nuclear Fuel (JNFL), a consortium of Japanese energy companies, builds a reprocessing plant for dealing with nuclear waste. Many problems have already been encountered while testing the plant, therefore it is uncertain whether it will be a matter of months or years for the plant to open its doors. To stimulate general international competition, the government wants to reduce energy prices for large companies. At the moment, Japans energy prices are the highest in the world. Scientists expect great problems, because at the moment the problems with energy concern their costs. If large companies are able to buy reduce-priced energy, the consumer will eventually pay for this reduction. A solution for the energy troubles is nationalizing of nuclear energy by connecting energy nets to one another. Another possibility will be a long term spread of the costs of the set-up of energy plants. One of the problems with the last option is the fact that energy plants are private enterprises and the urge for Japan to keep them open, to avoid a real crisis. Although the Japanese oil prices are among the highest of the world, the energy taxes are relatively low with only 6 percent. Yet, there is no product-specific tax for discouragement of certain rare energy products. The main reason for this government's choice is the fact that Japan fears to lose its competition position if Europe and the United States refuse to adopt this arrangement. Because the Japanese government promotes energy-efficiency, companies can claim subsidies for energy-generation and conservation programs. Compared with other countries, Japan invests the most in research and development of nuclear energy, with 80 percent of the total investment in energy R&D.

The Netherlands

The Netherlands is one of the largest energy consumers of the European Union (EU), probably because of the colder climate. Also the country's large petrochemical and horticultural industries play a big role in its energy consumption. But, where other EU countries nowadays consume 6 percent more energy than eight years ago, the Dutch consumption only rose with 2 percent. Almost 90% of the Dutch energy is generated from fossil fuels and less than five percent is produced by the only Dutch nuclear plant. After Italy, the Netherlands is the largest energy importer in the EU with almost one sixth of its total energy consumption. Most energy is imported from Germany and France and is mostly generated by

	Japan	The Netherlands
Electricity - consumption (2001)	964.2 billion kWh	99.42 billion kWh
(per capita)	7579.32 kWh per person	6155.84 kWh per person
Electricity - exports (2001)	0 kWh	4.209 billion kWh
Electricity - imports (2001)	0 kWh	21.49 billion kWh
Electricity - production (2001)	1.037 trillion kWh	88.32 billion kWh
Electricity - production by source (fossil fuel)	60,0%	89.9%
Electricity - production by source (nuclear)	29.8%	4.3%
Electricity - production by source (other)	1,8%	5,7%
Gasoline prices (world index 1998-2000)	1,74	1,69
Nuclear reactors operable	53 (44.153 MW)	1 (452 MW)

Table 5.12: Some energy facts.

water dams or nuclear plants. Because energy resources are scarce, the Dutch government stimulates the use of alternative, cleaner forms of energy to reduce the emission of carbon. The Netherlands is situated next to the North Sea, so windmills are in use to generate a clean form of energy. Also generators based on water force and solar panels produce more and more energy. By charging lower tax rates, the government tries to stimulate the usage of a clean form of energy. Since respectively 1998 and 2000, The Netherlands has to deal with new European Electricity and Gas regulations. By these regulations, competition and free market economy of energy should be stimulated. In the Netherlands, both production and transportation of energy was regulated by the government for almost 100 years. One of the expected results of the privatization is a decrease in energy cost, because of the free economy.

In table 5.12, some energy numbers about Japan and the Netherlands are presented.

Comparison

Japan is very dependent on nuclear energy while the Netherlands imports a large amount. Both countries use a lot of fossil fuels and are looking for alternative, cleaner forms of energy production. Both governments subsidize participation in energy programs.

5.8.9 Conclusion

That question to be answered is:

> *What are important economic forces that support or inhibit innovation at the national level?*

Several economic factors have been discussed in the text before and their influence on innovation was pointed out. Table 5.13 summarizes the differences in economic factors between Japan and the Netherlands.

Factor	Japan	The Netherlands
General economic situation / Business cycles	Stagnation of economy for 10 years after recession in early nineties.	Economy stagnated after global recession but is about to start growing again.
GDP/GNP	Growing at about 1% after recession. This is also expected for the upcoming years.	Growing slightly after small decrease. Good perspectives for the near future.
Interest rates	Extremely low. Almost 0%.	Relatively low (3%), but still a lot higher than in Japan.
Money supply	Government is trying to increase the money supply to stimulate the economy.	Government tries to limit the growth of money supply (which increases inflation).
Inflation	No inflation but actually deflation.	Around 3%, which is considerable. Was even higher because of the introduction of the Euro.
Unemployment	Has grown up to 6% because of the economic recession.	Was low (2%), but the recession has led to in increase. Now around 3%.
Income	The good economy (before 1990) led to a high income per capita. It now has more or less stabilised.	Has been lower than in Japan for a long time, but still is rising which is not the case in Japan
Energy	Most energy comes from nuclear plants. Pollution control programs are set up.	Most energy is imported from other countries. Pollution control programs are set up.

Table 5.13: Comparison table on national economy.

A general conclusion that can be drawn from these factors is that there is a strong relation between economy and innovation. In times that economy is flourishing, companies tend to invest and to grow larger and larger. These investments can be used for research and development which in turn can lead to innovation. Note that we do not claim that research and development and innovation are identical. This in general does not have to be the case. But we can state that a strong economy has a positive influence on innovation. On the other side when an economy is stagnating, investments are postponed and consumer are precautious when spending their money. Therefore it is hard for companies to sell new kinds of products which inhibits innovation. Companies can still spend money to innovate new products of course, but when they cannot sell these products they will not be tempted to innovate. Also it is hard to increase the amount of products that are being sold, so there is no demand for innovation of new, more efficient ways of production. So in short, it can be concluded that economy has a direct influence on innovation.

Business cycles describe how an economy is developing and therefore they can also indicate innovation. GDP/GNP is a measure of the size of an economy, so a growth in GDP/GNP usually is followed by an increase in innovation. Interest rates have an effect on innovation in several ways. Because of their influence on the spending and saving behavior of consumers and because of their influence on the amount of money that is borrowed from the banks. Inflation and deflation have a direct relation with the willingness to spend money. The current deflation in Japan motivates to postpone acquisitions. Income and unemployment determine how much money is earned and thereby how much can be spent.

The other factors that were discussed do have influence on economy and innovation of course, but they are not as important as the ones just mentioned.

To conclude things, a comparison between Japan and the Netherlands is made. Both countries suffer from a stagnation of the economy after a recession. In Japan this has been so for 10 years now, which is a considerable long time for economic stagnation. In the Netherlands the current economic situation is the result of the global economic recession which occurred in the year 2000. Nowadays a small growth of the economy can be seen and economy is expected to start growing again on short term. In Japan on the other hand only a very small growth of about 1% is expected for the upcoming years.

5.9 International politics

by Sebastiaan van Loon and Lodewijk Bouwman

This chapter about international politics gives insight to the main forces of innovation with regard to Japan compared with the Netherlands. The research question that has to be investigated is:

> *What are important political forces that support or inhibit innovation on the international level?*

To be able to give an answer to this question, different aspects have to be evaluated. In this chapter the following aspects will be discussed:

- Relations with other countries and current issues
- The relationships with and participation of international organizations
- Evaluation of the international politics during the last 50 years

On both bilateral and multilateral level relationships are important for Japans economic ties and safety which are important for innovation. The bilateral relations are discussed with the relations with other countries and the multilateral are discussed with the international organizations. These aspects will be also compared between Japan and the Netherlands, for Shouraizou being a study tour for Dutch students. In the conclusions an answer will be given for the research question.

5.9.1 Postwar developments of the international politics

Japan

When Japan regained its sovereignty in 1952 and re-entered the international community as an independent nation, it found itself in a world preoccupied by the Cold War between East and West, in which the Soviet Union and the United States headed opposing camps. By virtue of the Treaty of Peace which Japan signed in San Francisco on September 8, 1951 (effective April 28, 1952), ending the state of war between Japan and most of the Allied powers except the Soviet

Union and China, and the Mutual Security Assistance Pact between Japan and the United States, signed in San Francisco the same day, Japan essentially became a dependent ally of the United States, which continued to maintain bases and troops on Japanese soil.

Japan's foreign policy goals during most of the early postwar period were essentially to regain economic viability and establish its credibility as a peaceful member of the world community. National security was entrusted to the protective shield and nuclear umbrella of the United States, which was permitted under the security pact that came into effect in April 1952 to deploy its forces in and about Japan. The pact provided a framework governing the use of United States forces against military threats (internal or external) in the region. A special diplomatic task was to assuage the suspicions and alleviate the resentments of Asian neighbors who had suffered from Japanese colonial rule and imperialist aggression in the past. Japan's diplomacy toward its Asian neighbors, therefore, tended to be extremely low-key, conciliatory, and non-assertive. With respect to the world at large, the nation avoided political issues and concentrated on economic goals. Under its omni directional diplomacy, it sought to cultivate friendly ties with all nations, proclaimed a policy of 'separation of politics and economics', and adhered to a neutral position on some East-West issues.

During the 1950s and 1960s, foreign policy actions were guided by three basic principles: close cooperation with the United States for both security and economic reason,; promotion of a free-trade system congenial to Japan's own economic needs, and international cooperation through the United Nations (UN) (to which it was admitted in 1956) and other multilateral bodies. Adherence to these principles worked well and contributed to phenomenal economic recovery and growth during the first two decades after the end of the occupation.

In the 1970s, the basic postwar principles remained unchanged but were approached from a new perspective, owing to the pressure of practical politics at home and abroad. There was growing domestic pressure on the government to exercise more foreign policy initiatives independent of the United States, without, however, compromising vital security and economic ties. The so-called Nixon 'shock', involving the surprise United States opening to China and other regional issues, also argued for a more independent Japanese foreign policy. The nation's phenomenal economic growth had made it a ranking world economic power by the early 1970s and had generated a sense of pride and self-esteem, especially among the younger generation. The demand for a more independent foreign policy reflected this enhanced self-image.

Changes in world economic relations during the 1970s also encouraged a more independent stance. Japan had become less dependent on the Western powers for resources. Oil, for example, was obtained directly from the producing countries and not from the Western-controlled multinational companies. Other important materials also came increasingly from sources other than the United States and its allies, while trade with the United States as a share of total trade dropped significantly during the decade of the 1970s. Thus, political leaders began to argue that in the interests of economic self-preservation, more attention should be paid to the financial and development needs of other countries, especially those that provided Japan with vital energy and raw material supplies.

The move towards a more autonomous foreign policy was accelerated in the 1970s by the United States decision to withdraw troops from Indochina. Japanese public opinion had earlier favored some distance between Japan and the United States' involvement in war in Vietnam. The collapse of the war effort in Vietnam was seen as the end of United States military and economic dominance in Asia and brought to the fore a marked shift in Japan's attitudes about the United States. This shift, which had been developing since the early 1970s, took the form of questioning the credibility of the United States nuclear umbrella, as well as its ability to underwrite a stable international currency system, guarantee Japan's access to energy and raw materials, and secure Japan's interests in a stable political order. The shift therefore required a reassessment of omni directional diplomacy.

The realignment of United States and Japanese currencies in the mid-1980s increased the growth of Japanese trade, aid and investment, especially in Asia. It also accelerated the reversal of the United States fiscal position, from one of the world's largest creditors in the early 1980s to the world's largest debtor at the end of the decade. Japan became the world's largest creditor, an increasingly active investor in the United States, and a major contributor to international debt relief, financial institutions, and other assistance efforts. It appears clear to observers in Japan that the majority of the Japanese public and elite were satisfied with the general direction of Japan's foreign policy. That policy direction is characterized by continued close ties with the United States to sustain world stability and prosperity that are so beneficial to Japan, and incrementally more assertive Japanese policies, especially regarding international economic and political institutions and Asian affairs. Yet the world order is changing rapidly, and there are deep frustrations in some quarters in the United States, China, and Western Europe over Japanese practices. There also is some evidence of deep frustrations in Japan over Tokyo's seeming slowness in taking a more active world role. The possibility of more radical change in Japan's foreign policy, perhaps in directions more independent of the United States, remains a distinct possibility. [45] What happened in the last 10 years will be discussed in the rest of this section.

The Netherlands

The Netherlands abandoned its traditional policy of neutrality after World War II. The Dutch have since become engaged participants in international affairs. Dutch foreign policy is geared to promoting a variety of goals: transatlanticism, European integration, Third World development and respect for international law, human rights, and democracy. The Dutch Government conducted a review of foreign policy main themes, organization, and funding in 1995. The document "The Foreign Policy of the Netherlands: A Review" outlined the new direction of Dutch foreign policy. The Netherlands prioritizes enhancing European integration, maintaining relations with neighboring states, ensuring European security and stability (mainly through the mechanism of NATO and emphasizing the important role the United States plays in the security of Europe), and participating in conflict management and peacekeeping missions. The foreign policy review also resulted in the reorganization of the Ministry of Foreign Affairs. Through the creation of regional departments, the Ministry coordinates tasks previously divided among the international cooperation, foreign affairs and economic affairs sections.

As a relatively small country, the Netherlands generally pursues its foreign policy interests within the framework of multilateral organizations. The Netherlands is an active and responsible participant in the United Nations system as well as other multilateral organizations such as the Organization for Security and Cooperation in Europe, Organization for Economic Cooperation and Development (OECD), World Trade Organization (WTO), and International Monetary Fund. A centuries-old tradition of legal scholarship has made the Netherlands the home of the International Court of Justice, the Iran Claims Tribunal, the Yugoslavia and Rwanda War Crime Tribunals, the European police organization (Europol) and the Organization for the Prevention of Chemical Weapons.

Dutch security policy is based primarily on membership in NATO, which the Netherlands joined in 1949. The Dutch also pursue defense cooperation within Europe, both multilaterally (in the context of the Western European Union) and bilaterally, as in the German-Netherlands Corps. In recent years, the Dutch have become significant contributors to UN peacekeeping efforts around the world as well as to the Stabilization Force in Bosnia and Herzegovina (SFOR).

The Dutch have been strong advocates of European integration, and most aspects of their foreign, economic, and trade policies are coordinated through the European Union (EU). The Netherlands' postwar customs union with Belgium and Luxembourg (the Benelux group) paved the way for the formation of the European Community (precursor to the EU), of which the Netherlands was a founding member. Likewise, the Benelux abolition of internal border controls was a model for the wider Schengen Accord, which today has 10 European signatories (including the Netherlands) pledged to common visa policies and free movement of people across common borders. [46, 47]

Comparison

Japan and the Netherlands both became dependent on the United States after the World War II. Japan was also depending on the military support of the US, while the Netherlands was working on one united Europe for their own security and joined the NATO which made them also dependent on the military support of the US. The economies of the two counties expanded enormously and made the countries more independent of the United States. In the last 50 years Japan and the Netherlands are trying to join international organizations to secure the world peace and economic viability. The two countries spend enormous amount of money to develop the Third World countries. Later in this sections the international organizations will be shown and the role of Japan and the Netherlands with respect to these organizations will be discussed.

5.9.2 Relations with other countries

Relations with the United States

Japan-United States relations were more uncertain in the early 1990s than at any time since World War II. As long-standing military allies and increasingly interdependent economic partners, Japan and the United States cooperated closely to build a strong, multifaceted relationship based on democratic values and interests in world stability and development. Japan-United States relations improved enormously in the 1970s and 1980s, as the two societies and economies became increasingly intertwined. In 1990 their combined gross national product (GNP) totaled about one third of the world's GNP. Japan received about 11 percent of United States exports (a larger share than any other country except Canada), and the United States bought about 34 percent of Japan's exports. Japan had 148 billion US Dollar in direct investment in the United States in 1991, while the United States had more than 17 billion US Dollar invested in Japan. Some 100 billion US Dollar in United States government securities held by institutions in Japan helped finance much of the United States budget deficit. Economic exchanges were reinforced by a variety of scientific, technical, tourist, and other exchanges. Each society continued to see the other as its main ally in Asia and the Pacific. Certain developments in the late 1980s damaged bilateral relations. Nevertheless, public opinion surveys continued to reveal that substantial majorities of Japanese and Americans believed that the bilateral relationship was vital to both countries.

Growing interdependence was accompanied by markedly changing circumstances at home and abroad that were widely seen to have created a crisis in Japan-United States relations in the late 1980s. United States government officials continued to emphasize the positive aspects of the relationship but warned that there was a need for "a new conceptual framework."

Three sets of factors stand out as the most important in explaining the challenges facing Japan-United States relations. They are economic, political-military, and domestic in nature.

The relative economic power of Japan and the United States was undergoing sweeping change, especially in the 1980s. This change went well beyond the implications of the United States trade deficit with Japan, which had remained between 40 billion US Dollar and 48 billion US Dollar annually since the mid-1980s. The persisting United States trade and budget deficits of the early 1980s led to a series of decisions in the middle of the decade that brought a major realignment of the value of Japanese and United States currencies. The stronger Japanese currency gave Japan the ability to purchase more United States goods and to make important investments in the United States. By the late 1980s, Japan was the main international creditor.

Japan's growing investment in the United States –it was the second largest investor after Britain– led to complaints from some American constituencies. Moreover, Japanese industry seemed well positioned to use its economic power to invest in the high-technology products in which United States manufacturers were still leaders. [45]

Under Article 6 of the Japan-US Security Treaty, Japan makes available for US Forces the use of facilities and areas in Japan for the purpose of contributing to the security of Japan as well as international peace and security in the Far East, and the United States stations its troops in Japan. [48]

The relation with the United States is very stable and important for Japan's security.

Relations with China

The priority that policy toward China has commanded in Japanese foreign affairs has varied over time. During the period of United States-backed 'containment' of China, there was a sharp divergence between official policy and popular attitudes in Japan. As a loyal ally of the United States, the Japanese government was committed to non recognition, whereas popular sentiments favored diplomatic relations and expanded trade.

The unanticipated United States opening to China in 1971 undermined the administration of Prime Minister Sato, but the subsequent government of Prime Minister Tanaka Kakuei quickly adjusted policy by normalizing diplomatic relations in 1972.

Although its share of Japan's global trade was still small (3 percent in 1982), China became Japan's sixth largest trading partner. Japan regarded China as a significant source of coal, oil, and strategic minerals, such as tungsten and chromium, and as an important market for Japanese steel, machinery plant equipment, chemical products, and synthetic textile fibers.

The optimism that marked the economic relationship in the late 1970s had given way to a greater degree of realism on both sides by the early 1980s. China's decision to curtail imports of heavy industrial goods in 1981 and 1982 had a sobering effect on the Japanese.

Japan encountered a number of episodes of friction with China during the rest of the 1980s. In late 1985, Chinese officials complained harshly about Prime Minister Nakasone's visit to the Yasukuni Shrine, which commemorates Japan's war dead, and in mid-1986 they complained about the latest revision of Japan's history textbooks to soften accounts of World War II atrocities. Economic issues centered on Chinese complaints that the influx of Japanese products into China had produced a serious trade deficit for China. Nakasone and other Japanese leaders were able to reduce these official concerns during visits to Beijing and in other talks with Chinese officials. Notably, they assured the Chinese of Japan's continued large-scale development and commercial assistance. At the popular level in China, it was not easy to allay concerns. Student-led demonstrations against Japan, on the one hand, helped reinforce Chinese officials' warnings to their Japanese counterparts. On the other hand, it was more difficult to change popular opinion in China than it was to change the opinions of the Chinese officials. Meanwhile, the removal of party chief Hu Yaobang in 1987 was detrimental to smooth Sino-Japanese relations because Hu had built personal relationships with Nakasone and other Japanese leaders.

Japan is in the forefront among leading industrialized nations in restoring closer economic and political relations with China. Resumption of Japan's multibillion dollar aid to China and increased visits to China by Japanese officials, culminating in the October 1992 visit of Emperor Akihito, gave a clear indication that Japan considered closer ties with China in its economic and strategic interest. [45]

Japan's disappointment mounted as the Chinese leadership in 1994-95 stirred nationalist sentiments targeted at Japan. Some found it incredible that a great economic power that gave vast sums in official development assistance and presumably had considerable discretion over funds for foreign direct investment and trade could not exert pressure on a far poorer country in great need of economic development.

While most global attention focused on Japanese-Chinese rivalry, some Japanese and Chinese strategists anticipated a new regionalism that would lock the two countries together in an economic community that could serve as a balancing force in the world. [49]

China's industrial development is important for Japan as well. If, for instance, the Chinese manufacturing industry keeps on growing and sharpen its competitive edge in the world market, it would have a strong impact on Japan's manufacturing industry. It would also radically transform the current pattern of economic relationship Japan maintains with South East Asia and with China itself. [50]

Relations with other Asia-Pacific countries

Japan's rapid rise as the dominant economic power in Asia in the 1980s helped to define Japanese policy toward this diverse region, stretching from South Asia to the islands in the South Pacific Ocean. The decline in East-West and Sino-Soviet tensions during the 1980s suggested that economic rather than military power would determine regional leadership. During the decade, Japan displaced the United States as the largest provider of new business investment and economic aid in the region, although the United States market remained a major source of Asia-Pacific dynamism. Especially following the rise in value of the Yen relative to the US Dollar in the late-1980s, Japan's role as a capital and technology exporter and as an increasingly significant importer of Asian manufactured goods made it the core economy of the Asia-Pacific region.

From the mid-1950s to the late 1960s, Japan's relations with the rest of Asia were concerned mainly with promoting its far-flung, multiplying economic interests in the region through trade, technical assistance, and aid. Its main problems were the economic weakness and political instability of its trading partners and the growing apprehension of Asian leaders over Japan’s ‘overpresence’ in their region.

Japan began to normalize relations with its neighbors during the 1950s after a series of intermittent negotiations, which led to the payment of war reparations to Burma, Indonesia, the Philippines, and the Republic of Vietnam (South Vietnam). Thailand’s reparations claims were not settled until 1963. Japan’s reintegration into the Asian scene was also facilitated by its having joined the Colombo Plan for Cooperative Economic and Social Development in Asia and the Pacific in December 1954 and by its attendance at the April 1955 Afro-Asian Conference in Bandung, Indonesia. In the late 1950s, Japan made a limited beginning in its aid program. As in subsequent cases involving India, as well as Sri Lanka, Malaysia, Taiwan, Pakistan, and South Korea, these credits were rigidly bound to projects that promoted plant and equipment purchases from Japan. In 1960 Japan officially established the Institute of Asian Economic Affairs (renamed the Institute of Developing Economies in 1969) as the principal training centre for its specialists in economic diplomacy.

In the early 1960s, the government adopted a more forward posture in seeking to establish contacts in Asia. In 1960 the Institute of Asian Economic Affairs was placed under the jurisdiction of the Ministry of International Trade and Industry (MITI). In 1961 the government established the Overseas Economic Cooperation Fund as a new lending agency.

By the mid-1960s, Japan’s role had become highly visible in Asia as well as elsewhere in the world. In 1966 Japan became a full member of the Organization for Economic Co-operation and Development (OECD). As economic and trade expansion burgeoned, leaders began to question the propriety and wisdom of what they variously described as “mere economism”, an “export-first policy”, and the “commercial motives of aid”. They wanted to contribute more to the solution of the North-South problem, as they dubbed the issue – the tenuous relationship between the developed countries and the developing countries.

Efforts since the beginning of the 1970s to assume a leading role in promoting peace and stability in Asia, especially South East Asia, by providing economic aid and by offering to serve as a mediator in disputes, faced two constraints. Externally, there was fear in parts of Asia that Japan’s systematic economic penetration into the region would eventually lead to something akin to its pre-World War II scheme to exploit Asian markets and materials. Internally, foreign policymakers were apprehensive that Japan’s political involvement in the area in whatever capacity would almost certainly precipitate an anti-Japanese backlash and adversely affect its economic position.

After a reassessment of policy, the Japanese leadership appeared to have decided that more emphasis ought to be given to helping the developing countries of the region modernize their industrial bases to increase their self-reliance and economic resilience.

By 1990 Japan's interaction with the vast majority of Asia-Pacific countries, especially its burgeoning economic exchanges, was multifaceted and increasingly important to the recipient countries. The developing countries of ASEAN (Brunei, Indonesia, Malaysia, the Philippines, and Thailand; Singapore was treated as a newly industrialized economy, or NIE) regarded Japan as critical to their development. Japan's aid to the ASEAN countries totalled 1.9 billion US Dollar in Japanese fiscal year 1988 versus about 333 million US Dollar for the United States during United States fiscale year 1988. Japan was the number one foreign investor in the ASEAN countries, with cumulative investment as of March 1989 of about 14.5 billion US Dollar, more than twice that of the United States. Japan's share of total foreign investment in ASEAN countries in the same period ranged from 70 to 80 percent in Thailand to 20 percent in Indonesia.

In the early 1990s, the Japanese government was making a concerted effort to enhance its diplomatic stature, especially in Asia. Kaifu's much publicized spring 1991 tour of five South East Asian nations –Malaysia, Brunei, Thailand, Singapore, and the Philippines– culminated in a May 3 major foreign policy address in Singapore, in which he called for a new partnership with the Association of Southeast Asian Nations (ASEAN) and pledged that Japan would go beyond the purely economic sphere to seek an "appropriate role in the political sphere as a nation of peace." As evidence of this new role, Japan took an active part in promoting negotiations to resolve the Cambodian conflict. [45]

Relations with Iraq

One of the most striking features of the Constitution is its pacifist doctrine. However, the introduction of Self-Defence Forces (SDF) in 1956, the mutual security pact with the US in 1960, and a new law allowing Japanese troops to participate in UN peace-keeping operations led to pragmatic alterations of the original concept. [51]

In the beginning of 2003 Japan deployed SDF troops to Iraq. It commits Japanese troops to a zone where combat is continuing for the first time since World War II. [52]

The Japanese Defency Agency states: "On the basis of our experience, we believe that reconstruction of a peaceful Iraq is necessary not only for the peace and stability of the entire Middle East region and the international community but also for the peace and prosperity of Japan itself."

So the activities of the SDF in Iraq will focus on humanitarian and reconstruction assistance and are designed solely to help the people of Iraq in their attempt to rebuild their own country. [53]

The stationing of the SDF in Iraq is also important for the relation with the United States. Japan's Prime Minister Mr Koizumi repeatedly stressed the importance of maintaining the 50-year-old alliance with the United States during a televised news conference in March 2003. Tokyo's support for President Bush is not motivated by fear of Iraq, but by a much more immediate threat - the prospect of a nuclear armed North Korea. [54]

Relations with North Korea

On September 17, 2002, Prime Minister Koizumi visited North Korea and held a summit meeting with Kim Jong-Il, Chairman of the National Defence Commission of North Korea, and signed the Japan-DPRK Pyongyang Declaration. [55]

Japan agreed to resume negotiations with North Korea on normalization of relations by making Pyongyang admit to most of Japan's claims concerning the abduction of Japanese aid workers in the 1970s and 80s and the North Korean spy ship that, after an exchange of gunfire, was sunk in the East China Sea December 1998. [[56]

Other threads to Japan are North Koreas nuclear programmes, its stockpiles of chemical and biological weapons and the missiles to deliver them to Japan. [54]

The reason North Korea can be a thread to Japan is in its history, the story of North Korea's establishment is ultimately the story of the partisan movement led by Kim Il Sung, who liberated North Korea and put an end to Japan's colonization, which lasted from 1910. [56]

For most Japanese, the most important issue in dealing with North Korea is the status of Japanese citizens kidnapped or thought to have been kidnapped by North Korean agents. In the summer of 2002 North Korean leader Kim Jong-il admitted that North Korea's security service abducted 13 Japanese from Japan and Europe from 1977-1982. Only five of thirteen were still alive, according to North Korea. There are indications that these claims are not correct and that more abductees are still alive. [57]

Japan and North Korea have multilateral meetings about regional safety also in the Six-Party Talks together with the United States, China, Russia and South Korea. [55]

Japan's most important issues with North Korea are the abduction issues and regional safety. North Korea has weapons of mass destruction which can be used against Japan.

Relations with Russia

The 1980s saw a decided hardening in Japanese attitudes toward the Soviet Union. Japan was pressed by the United States to do more to check the expansion of Soviet power in the developing world following the December 1979 Soviet invasion of Afghanistan. It responded by cutting off contacts beneficial to the Soviet regime and providing assistance to 'front line' states, such as Pakistan and Thailand. Under Nakasone, Japan worked hard to demonstrate a close identity of views with the Reagan administration on the Soviet threat. Japan steadily built up its military forces, welcomed increases in United States forces in Japan and the western Pacific, and pledged close cooperation to deal with the danger posed by Soviet power.

Although public and media opinion remained skeptical of the danger to Japan posed by Soviet forces in Asia, there was strong opposition in Japan to Moscow's refusal to accede to Japan's claims to the Northern Territories, known to the Japanese as Etorofu and Kunashiri, at the southern end of the Kuril Island chain, and the smaller island of Shikotan and the Habomai Islands, northeast of Hokkaido, which were seized by the Soviets in the last days of World War II. The stationing of Soviet military forces on the islands gave tangible proof of the Soviet threat, and provocative maneuvers by Soviet air and naval forces in Japanese- claimed territory served to reinforce Japanese official policy of close identification with a firm United States-backed posture against Soviet power.

In January 1990, the Japanese Ministry of Foreign Affairs shifted its position, which previously had rejected negotiations with the Soviet Union on arms reductions, indicating that Japan would be willing to negotiate. Ministry officials stated that the government would formulate policy on arms reduction in close coordination with the United States.

Despite divergence on the territorial question, on which neither side was prepared to give ground, Japan's relations with the Soviet Union improved appreciably after the mid-1960s. The Soviet government began to seek Japanese cooperation in its economic development plans, and the Japanese responded positively. The two countries signed a five-year trade agreement in January 1966 and a civil aviation agreement as well.

This economic cooperation was interrupted by Japan's decision in 1980 to participate in sanctions against the Soviet Union for its invasion of Afghanistan and by its actions to hold in obeyance a number of projects being negotiated, to ban the export of some high-technology items, and to suspend Siberian development loans.

The government of Boris Yeltsin took power in Russia in late 1991 when the Soviet Union was dissolved. Once again, Moscow took a stand in firm opposition to returning the disputed territories to Japan. Although Japan joined with the Group of Seven industrialized nations in providing some technical and financial assistance to Russia, relations between Japan and Russia remained cool. In September 1992, Russian president Boris Yeltsin postponed a scheduled visit to Japan. The visit finally took place in October 1993. During the visit, although various substantive issues, including the Northern Territories and the signing of a peace treaty, were discussed, no significant improvement was seen in Japan-Russia relations. [45]

Since then the issue about the northern territories is still being discussed. [49] Because of the fact that Russia has a great influence on the security in the Asia-Pacific region, there are Defense Exchanges between Japan and Russia. [48]

This dispute is a major barrier for Japanese-Russian trade so Japan can not get many natural resources from Russia.

Relations with Western Europe

Although cultural and non-economic ties with Western Europe grew significantly during the 1980s, the economic nexus remained by far the most important element of Japanese-West European relations throughout the decade. Events in West European relations, as well as political, economic, or even military matters, were topics of concern to most Japanese commentators because of the immediate implications for Japan. The major issues centered on the effect of the coming West European economic unification on Japan's trade, investment, and other opportunities in Western Europe. Some West European leaders were anxious to restrict Japanese access to the newly integrated European Union, but others appeared open to Japanese trade and investment. In partial response to the strengthening economic ties among nations in Western Europe and to the United States-Canada-Mexico North American Free Trade Agreement, Japan and other countries along the Asia-Pacific rim began moving in the late 1980s toward greater economic cooperation.

On July 18, 1991, after several months of difficult negotiations, Prime Minister Kaifu signed a joint statement with the Dutch prime minister and head of the European Community Council, Ruud Lubbers, and with the European Commission president, Jacques Delors, pledging closer Japanese-European Community consultations on foreign relations, scientific and technological cooperation, assistance to developing countries, and efforts to reduce trade conflicts. Japanese Ministry of Foreign Affairs officials hoped that this agreement would help to broaden Japanese European Community political links and raise them above the narrow confines of trade disputes. [45]

Relations with the Netherlands

Japan and the Netherlands have a long relationship. The history of exchange between Japan and the Netherlands started when the Rotterdam ship "de Liefde" drifted ashore in Japan in 1600. From the end of the 16th to the beginning of the 17th century, during the warring states period, Japanese culture was strongly influenced by Portugal and Spain.

In 1639, the Tokugawa Shogunate prohibited the Portuguese from visiting Japan and decided to continue official trade only with the Netherlands. In 1641, the Dutch Factory of the VOC was relocated from Hirado to Deshima in Nagasaki and trade between Japan and the Netherlands entered a new stage. At this time, the Netherlands was the only country that provided Japan with western culture. During the Edo period western culture into Japan was almost exclusively imported through the Dutch Factory of the VOC in Nagasaki.

Japan's decision to open its borders to the Western powers in 1858 brought an end to the two hundred year Netherlands monopoly as the Western world’s sole representative in Japan. The two countries gradually lost interest in each other after 1900, partly because of Japan’s domestic and foreign policies. Relations reached their lowest point during World War II, after the Japanese conquest of the Dutch East Indies and the internment of numerous Dutch nationals. Relations were restored with ratification of the peace treaty in Washington DC in 1952. [58]

After the war the two countries took another path concentrating on different parts of the world.

As stated above the relationship of the two countries began in the early 16 century when the Netherlands were allowed to trade with Japan on the Island Deshima. From this an award is established, the Deshima award. The Deshima Award is meant to recognize extraordinary achievement of Dutch companies or institutions in the field of export, investment or technology transfer with regard to the Japanese market. The objective in presenting this award is to promote greater awareness among Dutch companies of opportunities for exports of goods and technology to Japan, as well as for investment in Japan. [59, 60]

Other relations between Japan and the Netherlands are through small, more economic, institutes, like Japanese External Trade Organization (JETRO), Technical scientific attache (TSA) and the Dutch & Japanese Trade Federation (Dujat). They are not big institutions that are known in the rest of the world, but they can take care of a good bilateral relation between Japan and the Netherlands. The mentioned organizations will be discussed here.

JETRO

The Japan External Trade Organization was founded in 1958, in order to promote the external trade of Japan. JETRO is closely connected with METI (MITI) and has 77 offices worldwide. In 1960 the Amsterdam office was established. JETRO focuses on the promotion of trade between Japan and the Netherlands and attracting foreign direct investment to Japan. To achieve these goals, JETRO employs various activities: JETRO gives information to Dutch exporters on the various aspects of the Japanese market. Also they have many publications about investment and setting up businesses in Japan. Most of them can be obtained free of charge at their Amsterdam office. A library with market reports, video’s and other reference material helps to answer the majority of trade inquiries.

Technical scientific attache (TSA)

The ministry of Economic affairs of the Netherlands have several TSA’s in different countries (United States of America, Japan, Germany, France, Singapore and Italy). These TSA’s jobs are to gather information about technologies and technology policies for Dutch companies, knowledge institutions, universities and the government.

The most important services of the TSA network are to inform Dutch companies and institutions of these technical developments and to make international contacts. The service they provide is free and is supported by the ministry in The Hague. [61]

Dutch &Japanese Trade Federation (Dujat)

Dujat, the Dutch & Japanese Trade Federation, is an independent, non-profit organization with offices in the Netherlands and Japan. Its aim is to strengthen and intensify the economic relations between the Netherlands / Europe and Japan. Dujat acts as a bridge for companies, supporting them in collaborative ventures in the fields of trade, investment and technology to and within Japan, as well as vice versa. To this end an extensive network of contacts, both in government and industry, is available in both countries. [62]

The relationship between Japan and the Netherlands fluctuates throughout the centuries. But the two countries are trying to recover their relations by different organizations. These relations are pushing companies and the governments to invest in each others economies and culture, resulting in a strong bond between the two nations that found each other two centuries ago. The influence of the relation between Japan and the Netherlands on innovation on an international level is not that visible, but supporting companies to seek new markets abroad can influence their investments in innovations that would not be made for their national market. The two governments can support one another when needed in difficult times. The goals of the governments on the international politics are practical the same, tying to establish world peace, stimulate a stable world market and support the Third World Countries through foundations and international organizations. If Japan and the Netherlands can propagate this to the rest of the world, than both countries can benefit of this and new innovations will certainly have more chances of succeeding.

5.9.3 International organizations

Nations work together through international organizations to make agreements on different aspects of their relations. These organizations play a mayor role in the international politics of a nation. In this paragraph different kinds of organizations will be mentioned that influence Japan and the Netherlands.

United Nations (UN)

The United Nations was established on 24 October 1945 by 51 countries committed to preserving peace through international cooperation and collective security. Today, nearly every nation in the world belongs to the UN: membership totals 191 countries. When states become Members of the United Nations, they agree to accept the obligations of the UN Charter, an international treaty that sets out basic principles of international relations. According to the Charter, the UN has four purposes: to maintain international peace and security, to develop friendly relations among nations, to cooperate in solving international problems and in promoting respect for human rights and to be a centre for harmonizing the actions of nations. [63]

The Netherlands was a founding member the UN. Eleven years later Japan joined the UN in 1956, it did so with great enthusiasm and broad public support, for the international organization was seen to embody the pacifist country's hopes for a peaceful world order. Membership was welcomed by many Japanese who saw the UN as a guarantor of a policy of unarmed neutrality for their nation. To others, support for the UN would be useful in masking or diluting Japan's almost total dependence on the United States for its security. The government saw the UN as an ideal arena for its risk minimizing, omni directional foreign policy.

World Trade Organization (WTO)

The World Trade Organization (WTO) is the only global international organization dealing with the rules of trade between nations. At its heart are the WTO agreements, negotiated and signed by the bulk of the world's trading nations and ratified in their parliaments. So the WTO has political influences. The WTO is described more extensively in 5.7.1.

International Monetary Fund (IMF) and World Bank

The IMF is an international organization of 184 member countries. It was established (in 1945) to promote international monetary cooperation, exchange stability, and orderly exchange arrangements, to foster economic growth and high levels of employment and to provide temporary financial assistance to countries to help ease balance of payments adjustment. [64]

The World Bank Group's mission is to fight poverty and improve the living standards of people in the developing world. It is a development Bank that provides loans, policy advice, technical assistance and knowledge sharing services to low and middle income countries to reduce poverty. [65]

The Netherlands was also a founding member of the IMF and the World Bank. In 1952 Japan became a member of the IMF and the World Bank, where it plays an increasingly important role.

North Atlantic Treaty Organization (NATO)

The North Atlantic Treaty Organization (NATO) is an alliance of 26 countries from North America and Europe committed to fulfilling the goals of the North Atlantic Treaty signed on 4 April 1949. In accordance with the Treaty, the fundamental role of NATO is to safeguard the freedom and security of its member countries by political and military means. NATO is playing an increasingly important role in crisis management and peacekeeping. [66]

The Netherlands was a founding member of the NATO and it takes part regularly in the peace operations of this organization. Japan is not a member of the NATO.

European Union (EU)

The European Union (EU) is a family of democratic European countries, committed to working together for peace and prosperity. It is not a State intended to replace existing states, but it is more than any other international organization. The EU is, in fact, unique. Its member states have set up common institutions to which they delegate some of their sovereignty so that decisions on specific matters of joint interest can be made democratically at European level. This pooling of sovereignty is also called “European integration”. The historical roots of the European Union lie in World War II. The idea of European integration was conceived to prevent such killing and destruction from ever happening again. It was first proposed by the French Foreign Minister Robert Schuman in a speech on 9 May 1950 [67]. The Netherlands was one of the leading countries in supporting the EU.

Other organizations and funding

The Dutch government attaches importance to the cohesion between its policy and that of the European Union and other international organizations such as the World Bank, not only in the areas of commerce and agriculture, but also in such areas as the environment, arms, immigration, and food safety and security. Since 2001, the Netherlands has been giving structural assistance to 22 developing countries, most of them in Africa. In addition, it is working with around 30 countries in specific sectors, such as the environment, commerce, human rights, peace building, and good governance. [68]

In addition to Japans UN activities and its participation in Asian regional groupings, such as the Colombo Plan and the Asian Development Bank (ADB), Japan is also involved, beginning in the 1950s, in worldwide economic groupings largely made up of, or dominated by, the industrialized nations of Western Europe and North America. Japan has participated actively since 1975 in the annual summit meetings of the seven largest capitalist countries (the Group of Seven) Canada, Germany, France, Italy, Japan, Britain, and the United States. [45] Japan is not a member of the ASEAN, which is an important organization in the Asian region, although Japan is a discussion partner and financier of the ASEAN. [69]

Colombo Plan

At the Commonwealth Conference on Foreign Affairs held in Colombo in January 1950, convened to exchange views on the needs of the Countries of Asia, a Consultative Committee was establish to survey needs, assess the resources available and required, focus world attention on the problems involved, and provide a frame work within which international cooperation efforts could be promoted to as is the countries of the area to raise their living standards. The Plan embodies the concept of a collective intergovernmental effort toward the economic and social development of member countries in the Asia-Pacific region. It provides a forum for discussion of development needs of member countries and through consensus implements programs in response to their identified needs. The primary focus of all Colombo Plan activities is human resources development in the Asia-Pacific region. [70]

Asian Development Bank (ADB)

Asian Development Bank is a multilateral development finance institution dedicated to reducing poverty in Asia and the Pacific. Established in 1966, it is now owned by 63 members, mostly from the region. It functions are:

- Extend loans and equity investments to its developing member countries (DMCs) for their economic and social development;
- Provide technical assistance for the planning and execution of development projects and programs and for advisory services;
- Promote and facilitate investment of public and private capital for development;
- Respond to requests for assistance in coordinating development policies and plans of its developing member countries. Of the 63 members, Japan and the United States are the largest shareholders, each with 15.9 percent. [71]

5.9.4 Conclusion

The international politics of Japan focus mainly on stability, peace and economics. These points have influences on technological development and innovation. This is reached by participation in different international organizations, relations with other countries and aid for developing countries with the goal of securing raw materials for its industries.

With this in mind we can give an answer to the question stated in the introduction:

> *What are important political forces that support or inhibit innovation on the international level?*

Relations with other countries

Japan has close relations with the United States, both economically and military. The economic relation can support innovation for Japan, the innovated products can be shipped to the United States. The military relation can inhibit Japan's military innovation because there is no need to do so for Japan.

The relation with China is important for the import and exports needed for innovation, just like most other Asia-Pacific countries, only industrial developments in

China can be a threat for Japanese industries. For the trade it is important that the region is stable, the Japanese efforts for peace keeping in the region can stimulate innovation. Japan's aid to Asian-Pacific countries stimulates innovations in those countries as well.

By sending SDF to Iraq, Japan has to take care those forces will not have to get into combat, because of its constitutional restrictions. So Japan has to be innovative with its SDF in a military way. Indirect the deployment of SDF in Iraq is important for Japan's safety, while Japan is dependent on US troops with respect to the treat from North Korea. To take away the threats for its safety, there are also negotiations with North Korea, while the lack of safety can inhibit innovation. The problem with these negotiations is that first the abduction issue has to be solved, before Japanese public opinion will allow stronger ties with North Korea.

Historically the relations with Russia are not very well, because of the territorial differences about the Northern Territories. This dispute is a major barrier for Japanese-Russian trade so Japan can not get many natural resources from Russia.

The economic ties between Japan and Western Europe are not significant. But there has been made a lot of effort to strengthen this relation on foreign relations, scientific and technological cooperation, assistance to developing countries, and efforts to reduce trade conflicts. This will give a boost to the Japanese industries to finance more innovative projects in both Japan and Europe.

The relation between the Netherlands and Japan is still very lean. It is supported by organizations that help companies to sell their new innovative products on each other markets. The governments can help each other to combine forces and stimulate a stable world market in a peaceful world.

Participation in international organizations

By participating with international organizations, more markets are open for Japanese industries. With these markets it is more profitable to invest in innovations for new products. These industries also need raw material for producing these products. In Japan there is a lack of recourses of these materials so the Japanese government must stimulate the producing countries of these materials. This is tried by participation in organizations like the Colombo Plan.

By joining the UN and signing the Mutual Security Assistance Pact Japan lacks funding for its defense system, which has a positive effect on military innovations in most countries.

International politics during last 50 years

Although Japan has become more independent through the years, it is still dependent on the United States for its security and economy. For resources Japan has become less dependent on Western powers. In this view Japan paid attention

	Japan	The Netherlands
Dependency of United States military	Treaty of Peace (1952)	NATO (1949)
Hostilities	Threat from North Korea Territorial dispute with Russia	No direct enimies
Troops in Iraq	Troops are stationed	Troops are stationed
Dependency of foreign resources	Very dependent	Independent
United Nations	Member since 1956	Founding member since 1945
WTO	Member since 1995	Member since 1995
IMF and World Bank	Member since 1952	Founding member since 1945
Regional organizations	Colombo plan (member) Asian Development Bank (member) ASEAN (discussion partner and financier)	EU founding member
Organizations in Japan or The Netherlands	Technical scientific attaché	Japanese External Trade Organization Dutch & Japanese Trade Federation

Table 5.14: Comparison table on international politics

to the financial and development needs of other countries, providing Japan with vital energy and raw materials supplies.

The Netherlands is dependent on NATO for its security where the United States play a major role but the Netherlands has its contributions as well. Economically the Netherlands has a co-operation with its neighboring countries in the EU and does not need to give development aid for countries supplying vital energy and raw materials supplies.

General conclusion

We can state that Japan becomes more independent for its natural resources on the United States by developing relations with other (mainly Asian) countries where these resources are available. These resources are important to be able to keep produce innovating products. Japan is also trying to explore new markets to develop new innovations that sell on those markets. Although the economy of Japan is still very conservative to let new foreign companies enter their market organizations like JETRO, TWA and Dujat support Dutch companies to enter the Japanese market and to invest in new innovations.

Another factor which is important for innovation is regional stability. For its safety Japan is dependent on the United States because of the pacifist doctrine in its constitution. Still Japan has its Self Defence Forces (SDF) so Japan has to be innovative with the use of its SDF. Furthermore North Korea can be a threat for Japans safety and its innovation so that is an important factor as well.

5.10 National politics

by Bert van den Berg, Eelco Dalhuisen and Laurens van Oostveen

The national politics of Japan and the Netherlands are analyzed in this section. The main research question is:

What are the important political forces that support or inhibit innovation on the national level?

First of all, the political structures of Japan and the Netherlands will be discussed and compared. A short summary of the Japanese political history will be given to make clear how Japanese used to rule the country, how they do it now and how it affects innovation. Secondly, the innovation policies and environmental law policies in Japan and the Netherlands are discussed and compared. These policies are important political factors for innovation. Thirdly some for innovation important national factors are discussed and compared. These national factors are corruption, bureaucracy, freedom of speech and human rights. Finally, a conclusion about innovation is drawn and the main question is answered. All the comparisons are summarized in a table, so it can be easily seen what factors affect innovation.

5.10.1 Political structure

Japan

History

Politics have of course always been important to a country like Japan, but it has not been until after World War II when the US took control of Japanese politics that a new constitution was written which changed the way Japan was run. The new laws provided a new freedom to the people, loosened the grip as a police state, and an overall improvement of employment law. Military forces were disbanded, war criminals were trialed and sentenced, and most Japanese became anti-militaristic even up to today. For the government this meant cut spending and attention on defense and start focusing on other tasks. But communism was rising and the US started interfering in the economy with anti-inflation and export stimulation. The Ministry of International Trade and Industry was born and run by ex-employees of the Ministry of Munition and civilian experts on export.

When the Korean War broke out, attention for internal affairs faded and renewals ceased. A new police-reserve was formed and a lot of government employees were fired. When later the US released their 'indirect rule' policy of Japan, they were forced to deploy and conceive their own new ideas, and former political figures were reinstated. The American grip however was not completely gone yet and many people still believed the American way was the only right way to go. With the war going, Japan was an important piece of the puzzle by providing supplies for UN troops, and another treaty was formed with the US. Japan was now required to add to the defensive strength to democracy in exchange for military supplies. Here started Japan's link to the Western democracies.

In 1955 many conservative and socialist parties became united under a coalition which bore the name LDP, the Liberal Democratic Party, which received heavy support from the business world. Even though the current treaty with the US was important to the recovery of Japan, the LDP Prime Minister made a new treaty with the US without consent of the Diet (the Japanese parliament). As a result, the Prime Minister was forced to retire and he got replaced by a candidate from the business world. With him, the focus of national politics shifted entirely from politics to business, and he promised to double the national income in ten years. He succeeded in six. [72]

Structure

The political system of pre-war Japan was not so much different from what it is now. Even though before it was not a real democracy (the emperor ruled with sovereign power), the government already showed a somewhat familiar idea: the Diet, the ‘highest organ of state power’. The Diet can be compared with Dutch parliament, although its election mechanism shows more similarity with the House of Lords and House of Commons in England. The Diet consists of the House of Representatives and the House of Councilors. Its members, 480 and 252 respectively, are all elected by the hundreds of constituencies. Even though the House of Councilors is the more important of the two, the House of Representatives can overrule their decisions if they can get a two-third majority. Together they are responsible for law-making in Japan.

Above, and composed out of members from, the Diet is the cabinet, which is lead by the Prime Minister (currently: Junichiro Koizumi from the LDP). The Prime Minister is not elected but instead appointed by and from the Diet. He has the power to appoint and dismiss ministers. The cabinet contains 12 ministries as well as multiple agencies and commissions. Together they form the executive branch of the government, to make sure things get done around the place.

On top of all is the emperor. No longer ruling with supreme power, Emperor Akihito now performs duties similar to the Queen of the Netherlands. The Emperor is the symbol of the State and unity of the people. The Emperor appoints the Prime Minister and Chief Judge of the Supreme Court as designated by the Diet, and performs only such acts in matters of state as provided for in the Constitution along with the advice and approval of the cabinet such as promulgation of amendments of the constitution, laws, cabinet orders and treaties, convocation of the Diet, dissolution of the House of Representatives, and so forth. [73]

Stability

Japan is a multiparty democracy that has experienced great stability in the post-war period. From 1955 until 1993, the conservative Liberal Democratic Party (LDP) ruled Japan without interruption. During that period, the main opposition party in the Diet was the Japan Socialist Party (JSP), which relied heavily on Japan’s labor unions for support and which in recent years has experienced a sharp decline in popularity.

In 1993, a multiparty ‘alliance’ took control without the LDP. However, the LDP was returned to power in June 1994 in an unpredictable alliance with the JSP and a small party, the Sakigake. In January, 1995 the LDP reclaimed the Prime Minister's chair, when Ryutaro Hashimoto replaced his JSP alliance partner, Tomiichi Murayama. Currently the largest parties in the parliament are the New Frontier Party and the Democratic Party of Japan, formed in 1996; all political parties except the Japan Communist Party (JCP) support the security alliance between the United States and Japan.

However, the public economic policy making is basically in the hand of the professional government bureaucrats rather than the elected legislature. The leading economic bodies in the government bureaucracy set economic policy with very few constraints. Committees of experts make recommendations to the leading organs which are invariably passed through the Diet with little or no modification or are simply implemented directly. The Japanese bureaucracy is professional rather than political. Of the executive branch, only the ministers are politically appointed; the rest is chosen on professional merit. This gives the bureaucracy a strong, independent decision-making role and a high prestige. The quality of the workers is even at such a level that some top bureaucrats retire from the public sector and assume a top managerial post in a private company.

Supervision

The basic premise is that the private sector alone has insufficient vision, coordination, resources and risk-bearing ability to conduct its affairs in an optimal manner. To alleviate bottlenecks, to avert overproduction, to anticipate market shifts, to develop and deploy uncharted technology, the government is needed to assist in the sharing of information, pooling of resources, and overall collaboration of efforts. When the Ministry of International Trade and Industry (MITI) was formed out of the old Ministry of Commerce and Industry in 1949, it quickly turned its attention to developing a dynamic, export-promoting industrialization strategy. The plan MITI evolved actually defied the conventional comparative-advantage approach to international trade. Rather than emphasizing labor-intensive, low-technology industries, MITI chose to promote the heavy and chemical industries in the early 1950s. The rationale was that this approach was consistent with a dynamic comparative-advantage analysis. If Japan concentrated on non-growth, traditional export sectors instead of modern growth industries, it would confine its whole economy to slow growth and backwardness in the long run. [74]

MITI has served as an architect, an arbiter and as a regulator but not so much along a centrally planned economy. MITI provided guidance and directions to industries, both formal and informal, on modernization, technology, investments and competition. This close relationship led to a foreign trade policy to strengthen domestic efforts by protecting from import competition, technological intelligence, licensing foreign technology, foreign exchange and assistance in mergers. [75]

Bureaucratic levers

One of the levers the government employs is the control over and supply of low- or no-interest funds to targeted industries. Such funds have constituted an important share of raised capital for prioritized sectors. These funds have also been used by the government to influence, if not determine, the number of enterprises in an industry.

Apart from supplying funds, prioritized sectors have also benefited from special depreciation and tax benefits. On the import protection side, the economic bureaucracy has used discriminatory tariffs, import quotas, subsidies for domestic producers, import restrictions, foreign currency cartels, and other non-tariff barriers to trade. The large Japanese trading companies assisted this effort in refusing to import finished goods which would compete with the output of their domestic clients. Also, the low interest rates have led to an undervalued Yen, which in turn led to continued export promotion and import reduction.

The Netherlands

The Netherlands is a constitutional monarchy. Parliament is elected by proportional representation, resulting in a coalition government. The Prime Minister is the head of the cabinet and coordinates the policy of the government, and is the face of the government towards the public. The cabinet requires the support of parliament or it will have no determining influence over legislation, so the ruling coalition is (practically) required to form the cabinet. Below the cabinet is the parliament which is divided in the First Chamber and the Second Chamber. The Second Chamber, consisting of 150 members, is considered to be more important than the First Chamber (75 members). The Second Chamber has the right to initiate and amend legislation, where the First Chamber only has the right and duty to approve or disapprove of anything passed on by the Second Chamber. [76]

Foreign Direct Investment

The Netherlands' trade and investment policy is among the most open in the world. The government maintains liberal policies toward foreign direct investments (FDI). With the exception of a few monopolies, foreign firms are able to invest in any sector and are entitled under the law to equal treatment. Since the early eighties there have been structural and integral reforms in the economic policy. Market competition was strengthened by the way of market forces: the government reduced its role in the economy by opening up the formerly public utilities sector for competition. [77]

Comparison of political structure

What Japan has as the House of Councilors is found in the Netherlands as the First Chamber, and the House of Representatives as the Second Chamber. Different is the fact that the Japanese Cabinet consists of members from the Diet, whereas Dutch constitution prohibits somebody to be a member of both the cabinet and parliament, but that only has a minor effect on how things are run. What is more important is the difference in expertise: in the Netherlands working as a civil servant is just another job, one works to fulfill the wishes of the ministry, while in Japan the situation is nearly reversed. In order to get a job in the economy section in the Japanese government one must pass an exam of such quality that only 5-10% passes. This makes the Japanese economy highly specialistic and there is such faith in the workers that they make up the policy instead of the minister. As an added bonus, this makes the economic branch independent of the elected government and provides high continuity.

The actual employed policies of both countries are however highly different. Where Japan was protectionistic and focused primarily on domestic industries and markets, the Netherlands employed an open-trade policy and used trade, investments and competition to grow.

5.10.2 Government policy: innovation policy

Japan

As figure 5.31 shows, the Japanese government funds a rather modest share of the Gross domestic Expenditure on R&D (GERD), less than 21% of the national total in any given year over the last decade. In 1997, the Japanese government spent 18.3 billion US Dollar on R&D while the private sector spent 71.9 billion US Dollar on R&D for a national total R&D effort of 90.3 billion US Dollar.

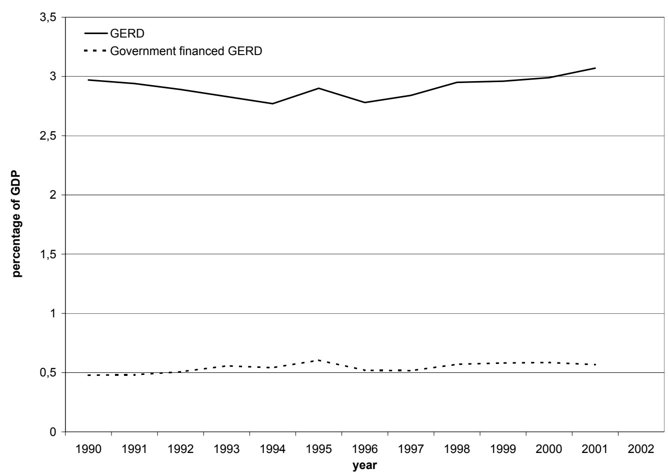


Figure 5.31: Japanese national S&T effort 1990-2001 [Eurostat, 2004].

The real decline in Japanese national (public and private sector) investments in R&D in the early part of the 1990s was the first-ever real decrease in the support for R&D in Japan, and in particular this represented the first real reductions in the private sector's support for R&D. Clearly, the economic stagnation in Japan for most of the 1990s has impacted the private sector's ability to support R&D. In the late 1980's, the private sector's investments in R&D were growing at an annual rate close to 10% a year. Between 1991 and 1995, the private sector R&D effort was in real decline. Japanese private sector R&D has been growing since 1995. Virtually all (98%) R&D carried out by Japanese industry is financed by the companies themselves. In 1997, over 75% of Japanese private sector investments in R&D are accounted for by the R&D efforts of the chemicals, pharmaceuticals, electric machinery, and transport equipment (i.e., automobile) industries [78].

Japan's long slide into recession for most of the 1990s led to the first year-on-year (in 1993 and 1994) declines in total R&D spending since the end of World War II. Some analysts have attributed the government's highly publicized decision in 1996 to double public investments in R&D to the shock resulting from this realization. That is, there was a feeling that investments in R&D were too important to the nation's future prosperity to leave these investments so exposed to the vagaries of the business cycle.

The government's current emphasis on trying to develop a stronger basic science system is at least in part a recognition that industrial support for basic science is being reduced substantially and that the timeframes for private sector R&D are contracting. Surveys of businesses indicate that private sector investments in basic research are indeed in decline. Once again the government realized that perhaps the public sector should increase its investments in these long term (presumably high-risk and hopefully high-payoff) R&D programs rather than letting national investments in basic research be so directly tied to fluctuations in the business cycle [78].

Trends within public sector support

In 1996, the Japanese government publicly committed itself to doubling "R&D investments by the government as soon as possible" from its 1992 level. This plan stated that it would be desirable to accomplish this doubling by the year 2000, which would require the Japanese government to invest a cumulative total of 96 billion US Dollar (17 trillion Yen) in R&D over the period 1995-2000. The initial proposed budget called for only a 0.9% increase in funding for R&D, which made it appear quite unlikely that Japan would be able to accomplish its much publicized goal of doubling R&D development spending by the year 2000 over the level in 1992. However, because of the increasingly worrisome financial situation in Japan, the Japanese government released in mid May 1998 a comprehensive economic stimulus package that contained 3.53 billion US Dollar (618.8 billion Yen) increase in spending for S&T. On December 4, 1998, the government announced another stimulus package that contained a further 2.95 billion US Dollar (511.1 billion Yen) for S&T. Taken together these S&T stimulus packages along with the regular budget allocation represent an increase of 38.7% over the previous year.

Perhaps unsurprisingly, much of the money in the science portion of these stimulus packages was earmarked for projects that will have direct and rather immediate economic benefit. For example, projects included 2.9 billion US Dollar for new dormitories for foreign scientists and students, construction of a new high-speed internet backbone to connect universities and national laboratories, construction of new laboratory space, development of a more powerful rocket booster for Japan's space program, and the start of the construction of a new 350 million US Dollar ocean drilling ship.

In addition to these infrastructure projects, the extra funds in these stimulus appropriations favor research programs that appear to have significant commercial application (e.g., nanotechnology, information science, and molecular biology). The additional research funds appear to have relatively little money for existing "small science" research programs. Moreover, due to budget decisions made before the stimulus was announced, funding for certain government research institutes and large scientific facilities (e.g., high energy physics facilities) will actually experience cuts of 10% or more in their operating budgets this year. The increasing use of these financial stimulus packages certainly helps to increase overall Japanese investments in S&T, but it has also raised concern that these stimulus packages' preference for funding projects with immediate economic payoff is starting to shift Japan's S&T program away from the government's stated goal of increased support for basic science [78].

Science and Technology Basic Plan

In addition to calling for a doubling of the public sector's support for R&D, the 1996 "Science and Technology Basic Plan" (which lays out Japan's current national science policy and goals) called for a fundamental overhaul of the Japanese S&T system. The hoped-for result of these changes would be to create a national science system that fostered a more "creative research atmosphere." It is hoped that this new research atmosphere would be capable of producing a science system in Japan that produced world class basic science and world class scientists. Moreover, in its final report issued in December 1997, the Administrative Reform Council specifically advocated that government programs that have funded applied research programs that benefited a specific industry be scaled back or terminated. The report instead advocates funding for basic research and technology programs that are "one or two stages away" from commercial product development. This new framework for Japan's national S&T goals stands in rather sharp contrast to the S&T goals pursued since the end of World War II, which centered on targeted industrial research (in the vernacular, "picking winners and losers") and adopting technologies from abroad to help Japanese industry "catch-up" with the West. Some of the major S&T reforms underway include [78]:

- Establishing new peer-reviewed research programs along with concerted efforts to decrease the portion of research funding given to national universities in block/formula grants by increasing the total amount of research support that is awarded competitively;
- Removing regulations and administrative procedures that hinder the private sector's ability to work with university-based researchers;

- Addressing long-standing human resource issues that are hindering Japan's ability to increase the number of scientists (as opposed to engineers) – and in particular the number of scientists with advanced degrees – working in Japan by initiating programs to increase the number of post-doctoral researchers working, increase the mobility of scientists and engineers, and increase the number of students entering S&E studies at universities;
- Attracting significant numbers of foreign scientists to come live and work in Japan until Japan can grow an indigenous cadre of basic scientists;
- Improving and modernizing research facilities and equipment at national universities and government research laboratories.

Second S&T Basic Plan

In the five years, due to the impact of the First S&T Basic Plan, the R&D level in Japan has been elevated (see figure 5.31). However recovery of industrial competitiveness is not yet sufficient and economic growth of Japan is not promising in the aging and low-birth-rate society. It is further important, therefore, to reinforce industrial technology leading new industry generation and to restore strong international competitiveness. It is also clear that the doubling of the public sector's contributions has not been reached in the year 2000. The contribution as percentage of GDP did increase over the last decade, but the contributions level in the year 2000 does not come close to a doubling of the contributions of the year 1992, which was the goal set in 1996 [79].

In 2001 the government of Japan has been reorganized, which includes establishment of the Council for Science and Technology Policy, the Ministry of Education, Culture, Sports, Science and Technology and so on, and transformation of major national research institutes into independent administrative institutions. As part of this reform, reform of universities has been underway. National universities are also engaged in deliberations regarding their transformation into independent administrative institutes and further reforms. Since now, as a control tower to implement S&T policies, the council will formulate promotion strategies on prioritized areas, principles of resource allocation, guidelines for project evaluation, and will strive to promote S&T activities in such high quality that are able to contribute development of the world. They set forth the second Science and Technology Basic Plan (2001-2005) [80].

The Second Basic Plan for S&T sets a target for government S&T-related spending of 24 trillion Yen for the period 2001-2005. This would raise the S&T-related government budget to 1 percent of GDP at the end of the period, assuming a GDP growth of 3.5 percent per year. This would represent an increase in government S&T-related expenditure of 19 percent compared to the period 1995-2000. It seems, however, likely that neither the assumption of GDP growth nor the target of 1 percent of GDP will be fully realized by 2005.

Japan will promote necessary R&D activities in accordance with priorities on resolving national/social problem such as enhancement of international competitiveness and countermeasures against aging and low-birth-rate society or global environmental problem, so that affluent, comfortable and safe society can be established and maintained. Also Japan will deal with newly emerging fields where rapid developments are expected with foresight and mobility. At the same time, Japan will secure proper resources for promotion of basic researches, because new findings in R&D might bring breakthroughs and linkage of basic research and industrial application has been getting tight. [80]

The Netherlands

Figure 5.32 shows trends in the performance of R&D in the Netherlands R&D over last decade. Growth in national R&D expenditures slowed significantly at the start of the 1990s. When corrected for inflation, the growth in R&D expenditures was 1.5% per year from 1990 to 1995. From 1985 to 1990, growth was 2.71% per year. Over the past decade, the contribution of the different sub-sectors (private R&D, university R&D, and semi-public R&D) to national R&D performance has remained relatively stable.

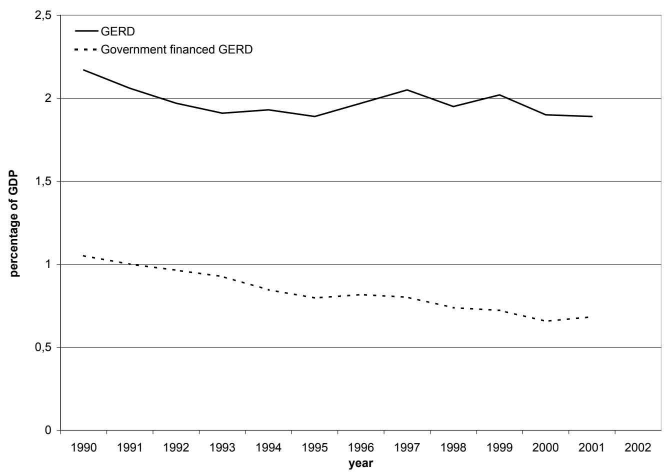


Figure 5.32: Total national R&D in the Netherlands [Eurostat, 2004].

In 1990, 48% of the national R&D expenditure was financed by the government; however, by 2001 the government's share had fallen to 36%. The private sector's share in national R&D financing decreased over the period of 1985-1995 from 49% to 46%, but steadily increased to 50% in the year 2001.

The contribution of the private sector is nearly the same, but the contribution of the government has decreased by 12%. This can be explained by the increase in resources coming from abroad. Between 1990 and 2001, R&D performed in the Netherlands that was financed by a foreign source increased almost six fold. One significant manifestation of this increasing internationalization is the Netherlands' growing participation in R&D programs sponsored by the European Union [81, 82].

Trends in public R&D

In recent decades, Dutch economic policy has changed continually. This applies for both general economic policy (competition policy and structural economic reforms) and for industrial policy. Strong government intervention during the era of (re-)industrialization policy in the 1950s and the period of selective growth policy (end of the 1970s) had gradually made way for government restraint. However, even in that turbulent period, a 'sectoral structure policy' never became a matter of principle in the Netherlands. This is a policy in which the government formulates concrete plans and ideas for the required future sectoral structure. The transformation from the actual to the required sectoral structure calls for extensive policy efforts, promoting the preferred economic activities and discouraging the unwanted ones [83].

Throughout the 1990s the Dutch government has worked to develop a more thoughtful and selective approach to its allocation of R&D resources (both in the national Technology Policy (Ministry of Economic Affairs) and in the Science Policy (Ministry of Education, Culture and Sciences)). This approach is driven, in part, by budgetary considerations and also by the realization that knowledge is increasingly important to the overall health of the economy. One aspect of this more thoughtful and selective approach to funding R&D is the government's desire to fund research in selected strategic research areas (e.g. energy R&D) that can simultaneously meet both businesses' needs and societal needs. An extensive strategic foresight activity was started in 1992.

In 1995, the policy strategy document "Knowledge in Action" was published by the Ministry of Economic Affairs and the Ministry of Education. This policy document formalized much of the government's new thinking about science and technology policy. One of its central ideas was the need to increase the "interaction between producers and consumers of new knowledge." That is, the government needed to find new ways to increase cooperation and interaction between private firms and the semi-public research institutes to actually increase the application of knowledge generated. Another change in the government's science policy –in line with the mentioned way of thinking– are the changes in the way universities and semi-public research institutes are supported. In particular, the government is attempting to move these institutions' support away from block grants and towards a system that is more based upon merit. As a result, universities are becoming more and more dependent on the 'second flow' (merit-based or peer-reviewed) grants. In addition, universities have been encouraged to increase their contract research activities with the private sector (the so called 'third flow' of resources) [81].

The semi-public research institutes (e.g., the Netherlands Energy Research Foundation (ECN) and the Netherlands Organization for Applied Scientific Research (TNO)) are being encouraged "to operate in a market-oriented way." To accomplish this, the government is subjecting the direct subsidy it provides to these institutes to an increasing level of input from the 'demand side', i.e., the private sector. The government believes that, by directly involving the private sector in setting priorities for the research carried out at universities and semi-public research institutes, the private sector will be more likely to make use of research results [81]. For the semi-public research institutes, the majority of whose efforts are in applied research. This reduction in funds from the national government has resulted in heightened efforts to attract funds from the private sector. Semi-public research institutes received 22.9% of their funding from private companies in 2000, up from only 12% in 1990 [82].

The majority of industrial policy is designed to realize the positive external effects of technology and know-how. Because of the major economic and social importance of R&D, the government pursues an active policy to prevent under-investment in private R&D. The CBS reports that financial problems often mean that innovative projects do not get off the ground at all. This calls for attention. There is ample private capital available, but too little of it is used for new business activities. This is because innovative projects often involve new fields of knowledge in which the risks are high and the returns uncertain. The Dutch capital market has a number of problems with the supply of capital for innovative investment projects, certainly in comparison with the US and British markets. As a result, technostarters, in particular, have considerable difficulty in realizing financing. However, the social benefits of innovation are too great for the government to allow this situation to take its own course. This is why the government pursues an active policy aimed at removing or reducing these problems [83].

The private sector is being encouraged to increase its own R&D efforts through an expanded R&D tax credit. The private sector is also being encouraged to increase its partnership activities with other firms, with universities, and with semi-public research institutions. Currently, most government R&D programs require private firms to partner with other R&D providers as a condition for receiving support.

The ultimate goal of these new government initiatives extends beyond the quantitative growth of the R&D enterprise. The new programs are also seeking to stimulate technological innovation in the Netherlands and to ensure the more efficient application, commercial and otherwise, of the knowledge generated by the nation's R&D networks [81].

Comparison

In the last decade contribution to R&D by the Dutch government has been decreasing compared to the average value of the EU (as percentage of GDP). However in Japan this percentage was steadily increasing over the last decade. Figure 5.33 shows the decreasing contribution of the Dutch government over the years 1990 to 2001. In the same figure the increasing contribution of the Japanese government can be seen.

The governments' spending as a percentage of the national GERD is showed in figure 5.34. The share of GERD of the Dutch government has been above 34%

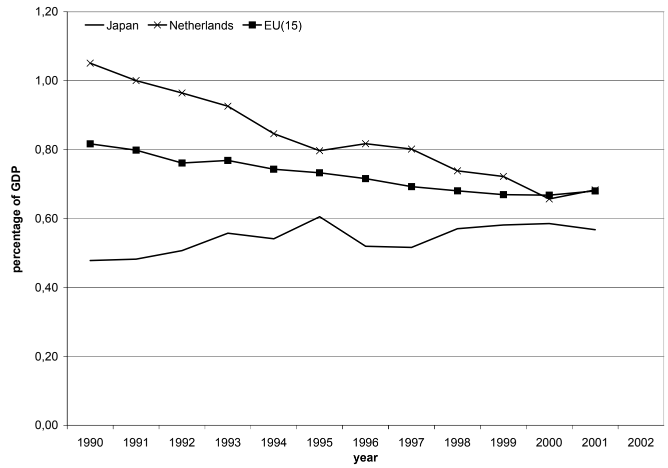


Figure 5.33: Government financed GERD (%GDP) from 1990-2001[Eurostat 2004].

of the national R&D expenditure in the last decade. It can clearly be seen that the share of the Dutch government is decreasing, but it has to be noted that the share contributed to the Dutch GERD by the EU has increased over the last years. In Japan the share of the government has remained around the 20 percent. Only in recent years the Japanese government has committed itself to increase the government spending on R&D, which has resulted in an increase from 16% (1990) to 20% (2000) [79].

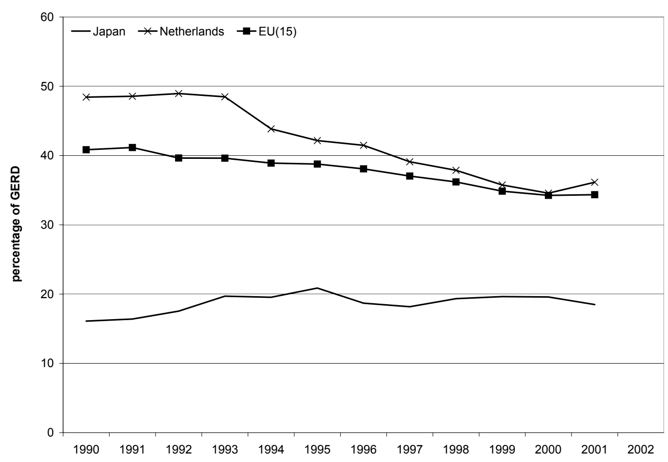


Figure 5.34: Government financed GERD (%GERD) from 1990-2001[Eurostat 2004].

In figure 5.35 a comparison of the GERD as percentage of GDP is made of Japan, the Netherlands and the European Union (with 15 countries). After a steady decline, the intensity of R&D expenditure has been growing since 1994 in Japan.

However, during the same period, in the European Union the intensity of R&D expenditure has remained at around 1.9% of total GDP, showing a slight increase since 1997. The Netherlands fluctuate around the average value of EU(15). The national GERD of Japan is about 1% of GDP higher than that of the Netherlands. Whereas the contribution of Japan as percentage of GDP is lower (see figure 5.33). Note that the part of a GERD of the Netherlands is funded by the EU and the government funding of GERD is still higher than that of Japan [79].

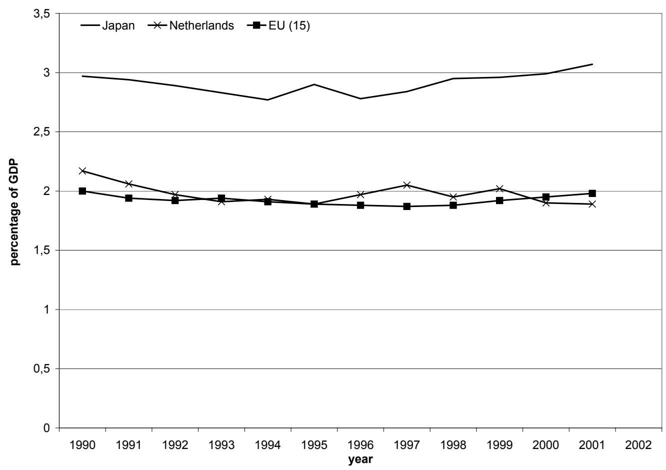


Figure 5.35: GERD (%GDP) from 1990-2001 [Eurostat 2004].

Japan and the Netherlands are both reducing regulations that hinder companies to innovate. The given support is more and more given as competitive support, also pushing universities and institutes to acquire funding from the private sector. So with regards to a lot of points Japan and the Netherlands are alike and growing towards each other. Within the EU the Netherlands has signed an intention to achieve a GERD of 3% of the GDP by the year 2010. Whereas Japan, having a GERD of 3% already, is trying to increase it and they are also trying to increase the role the government plays in it.

5.10.3 Government policy: environmental law and policy

Japan

Just like the S&T Basic Plan, the Japanese government has formed a Basic Environment Plan to cope with environmental issues. They acknowledge the delicacy of the ecosystems and deem it a common birthright of both present and future generations. They are aware of the problems of over-exploitation and the substantial increase of produced waste. This they blame on the expansion of human activities, the transfer to modern industrialization, and therefore feel the necessity of reviewing the human behavior. Secondly they believe developed countries should structure foreign aid to meet the needs of developing countries. For itself, Japan has set 4 main long-term objectives:

- Closed material circulation: burdens on the atmosphere, the water and the soil are caused by interference with nature's circulation of materials. Things extracted from earth's nature therefore should pass through the system cleanly and efficient. Waste must be limited and disposed of properly;
- Harmonious coexistence: nature and mankind mutually affect each other. For mankind to prosper, nature has to prosper, so they aim for nature and wildlife conservation plans and places of contact to ensure a rich exchange between human and nature. It means the maintenance and restoration of a healthy ecosystem and a harmonious coexistence;
- Participation: in order for the lifestyles to be reviewed and coexistence to be harmonious, every sector needs to fully understand the relationship that exists with nature. Every sector has to participate voluntarily and actively in their efforts to utilize the environment and reduce the burdens they place on the environment;
- International effort: for the global environmental effects, Japan is as dependent as the rest of the world. Japan strives to apply their experience and technology to contribute its part to the environment appropriate to its position in the global society.

Side-effects

In order to enact this plan, the government has taken a number of measures into this direction. Under the Kyoto protocol of 1997, Japan is committed to reducing its total carbon emissions by 6% from 1990 to 2010. So far however, emissions have increased 17% instead of decreased. To counteract this, the government is placing increased emphasis on the diversification of its energy sources. In addition to nuclear power, Japan is looking to increase its share of solar, hydro and other carbon-free, non-polluting renewable energy sources. The effects on businesses are direct as well as indirect. Japan intends to employ the PPP or Polluter Pays Principle (environment tax) to evenly spread the burdens where they are the most due. Most of the regulations are enforced by local prefectures instead of the national government, which have to follow the national guidelines but usually have their own, even stricter, set of measures. In short however, it still boils down to the same: reduce waste and greenhouse emissions.

In general the relation between economy and environmental protection is considered incompatible. It can be witnessed how economic performance is affected when attempts at the environment are made in times of economic stagnation. This is clear in developing countries, where the vicious circle of poverty and environmental disruption lives, but Japan has also had its bad times with this. There was a time of too much emphasis on direct economic profit which caused so much damage that could not be restored without external funds. So now there is the need to adopt methodologies to make it possible to weigh the economy and the environment. With those one can make decisions with consideration given to the environment in the sector of economic policy. Needless to say, there is an interest in the utilization of economic policy measures which will lead to greater attention to environment conservation while assuring the freedom of responses by the public and entrepreneurs. Some employed measures are:

- Charges and taxes: depending on the amount of pollutants emitted and the frequency of using environmental resources, the idea is to encourage the efficient utilization and distribution of natural resources in the environment;
- Emission trading: the tolerable emissions of pollutants are predetermined and the plants whose emission exceeds that value purchase the right to emit from other plants. This idea is based on reducing emission as a whole instead of individually;
- Deposit system: deposits are paid on products that require recycling, e.g. cola bottles, which will be refunded when the products are turned back in;
- Subsidies: offer subsidies for activities that actively regenerate the environment, like recovery of forests. [84, 85]

The Netherlands

Preservation of nature and environment is an important subject in the Netherlands, not only from the government but also tremendous pressure from the people. The main concern is the so-called climate change that is happening; in the last 30 years the average temperature has risen by 1 degree Celsius. Whether caused by a natural phenomenon or through human behavior, global warming is on people's minds the most. The Dutch policy is therefore geared towards reducing the emission of greenhouse gases (the Netherlands is bound by the Kyoto treaty as well) and to facilitate the adaptation of flora and fauna to the changes in climate. Linked to the latter is the conservation of species. Large areas of the country have been 'reserved' to provide natural habitats for birds and other wildlife. To further protect these areas are laws on nitrogen deposition, use of nitrates and ammonia emissions.

Some of these policies have become in force only recently, but the efficiency of some is questionable. These laws are followed to the letter instead of being used as a guiding ruleset. Activities that disturb feeding grounds, and dispersion and migration routes, are deemed irrelevant. The Birds Directive, which does not permit actions that affect the life of birds, is condoned outside of the breeding season. To successfully implement these laws, up-to-date information is needed on the relevant species. Data on species dispersion and range for a number of areas in the Netherlands are inadequate. Moreover, the data available are in urgent need of an update. [86]

Comparison

Just like Japan, the Netherlands' prospects of meeting the Kyoto demands are low. There are some emergency plans in place to help achieve the target emission, like raising the energy tax, raising the duty on fuels, or plain underground storage of CO_2. Either case, both governments are more or less actively working on their emissions. On the other hand, Japan seems less interested in preserving wildlife and creating reservations. This attitude can be attributed to the fact that Japan is largely uninhabitable for humans anyway and therefore provides its own natural reservations.

5.10.4 National factors: corruption

Corruption is an unwanted phenomenon that exists in all countries over the world. The definition of corruption, according to the Dutch ‘van Dale’ dictionary, is: “Deceit by unfairness or bribery during job practicing.” Corruption can cause several problems. Some characteristics of corruptions are that it [87]:

- Traps millions of people in poverty and misery;
- Undermines democracy and the rule of law;
- Distorts national and international trade;
- Jeopardizes sound governance and ethics in the private sector;
- Breeds social, economic and political crises;
- Threatens domestic and international security;
- Retards social and economic development;
- Threatens the sustainability of natural resources.

Corruption should be combatted to create governmental integrity, an important factor for a climate that supports entrepreneurs [88]. This is why innovation is hindered by corruption, because innovation needs a climate that is supporting for entrepreneurs.

Corruption exists on several levels: from a policeman that keeps the penalty money for himself to a building company that pays a politician for better contracts in the future and so on. Corruption exists in every country, but not every country has the same amount of corruption.

According to drs. Verberk from the Free University in Amsterdam, corruption correlates with the degree of democratization [89]. She discovered that the more a country is democratized, the less corruption it has (see figure 5.36). This correlation is almost linear.

The reason for this is that non-democratized countries have less clear borders between the ruling powers. This can result in dominance of the politics over administrative domain and the contrary. Another reason is that people in non-democratized countries do not have freedom of speech which makes it harder for them to take on corruption. The research of drs. Verberk depends on the expert-survey of Huberts in 1994. 257 experts from 49 countries could give their survey of the size, the causes and the strategies to contest corruption and fraud.

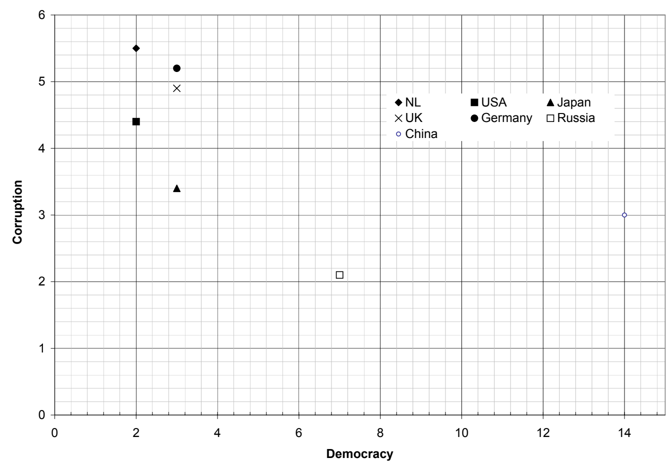


Figure 5.36: Correlation between corruption and democracy.

The source of the indicator of democracy is Freedom House, an organization that criticizes the degree of respect to human freedom and political rights of civilians in countries.

Transparency International (TI) is an international non-governmental organization that is devoted to combat corruption [87]. This organization monitors the corruption in 133 countries and publishes articles about it on her website. Transparency International also publishes the Transparency International Corruption Perceptions Index. This Index seems to be one of the best corruption indicators. A country without corruption scores 10 points in this index and a very corrupt country scores 0 points. The score relates to perceptions of the degree of corruption as seen by business people, academics and risk analysts. The CPI scores correlate with a factor of 0.87 with the scores of Huberts. The CPI scores of some countries are shown in figure 5.37.

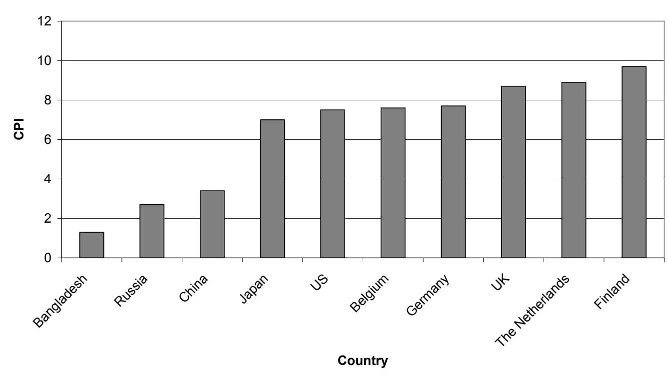


Figure 5.37: CPI scores.

Japan

With 7.0, Japan is on the 22nd place in the TI Corruption Perceptions Index 2003. This means Japan is a country that is relatively clear of corruption, but not totally clear. Several bribery scandals occurred in the past [90].

The most famous example is the Lockheed scandal. Lockheed, an American aircraft manufacturer, paid some political donations to Japanese politicians in return for an aid in selling planes to All-Nipon Airlines. This scandal led to the resignation of Kukuei as Prime Minister and a member of his party. Another example is the 1988 Recruit scandal which led to the resignation of several cabinet ministers, including Prime Minister Takeshita, whose closest aid committed suicide, and to the arrest of 20 people. Politicians profited from insider trading. After the Sagawa Kyubin scandal (1992/1993), in which Sagawa paid more than 2.5 billion Yen to 200 Diet members and leading local politicians, the Political Funds Control law was changed to make the flow of political donations more transparent. The main idea was to shift the responsibility of the raising of the funds from politicians to the parties. Diet members could only have one fundraising organization to which donors could legally transfer up to 500,000 Yen per year. Since the year 2000, Diet members are only allowed to receive donations from individuals, local party chapters and party headquarters. But corruption is still there in Japan. Even in 2003 some corruption scandals happened. Interviews with Japanese people made us believe that in everyday-life people don't directly suffer from corruption in Japan.

The reason of these corruption scandals in Japan is that the politicians and developing industry are closely connected, so the risk of bribery is bigger [91].

The Netherlands

The Netherlands scores better than Japan in the Transparency International Corruption Perceptions Index. The Netherlands are on the 7th place with a score of 8.9 points. This is almost 2 points higher than Japan. The conclusion is that the corruption in Japan is higher than the corruption in the Netherlands. But the Netherlands also have problems with corruption. The number of corruption cases in the Netherlands is estimated by the Free University on 350 per year. Some recent scandals are the HBO-fraud and the Bouw-fraud.

In the Bouw-fraud several building companies were involved and covered more scandals. First there was a scandal with a double bookkeeping which proved that some building companies made agreements about prices before making an offer. These agreements caused customers to pay too much. Making agreements on this way is forbidden since the beginning of the nineties. In the HBO-fraud HBO and MBO schools were involved. These schools committed fraud with the numbers of students. In this way they received too much money from the government.

The reason for these scandals is the same as the Japanese reason for corruption: the close connection between politics and industry. But it is not as bad as in

Japan [92].

Comparison

According to the Transparency International Corruption Perception Index and the research of Huberts, the corruption in Japan is higher than the corruption in the Netherlands.

5.10.5 National factors: bureaucracy

Bureaucracy is an important factor in slowing down the making of decisions and the arranging of things. Small companies do not have problems with it inside the company, but bigger companies have. The reason is that different tasks done by different people must be controlled by the management, so everything must be recorded to make control possible. A government is a kind of big company with a lot of different employees who have different tasks. This means that a lot of paperwork is recorded. If this is done ineffective then it will slow down the total system. This means that the bureaucracy is slow. This is undesirable because time is money, and money is what a government needs so it can govern a country. Besides the money, annoyance is another problem caused by bureaucracy. This can lead to a lack of respect, a breakdown in communications and a 'we-and-them' attitude developing [93].

Bureaucracy can also lead to a deduction of innovation [94]. This is because bureaucracy slows down the making of decisions. Innovation needs fast results and fast decisions.

Japan

The Japanese bureaucracy is infamous for making business life complicated [93]. Especially start-up companies have problems with it, whether Japanese or foreign. The reasons for the big bureaucracy are the more then 10,000 regulations and the people who maintain them [93]. Japanese civil servants do everything exactly in conformance with the rules. It is said that this makes it harder to communicate with them so request and other bureaucratic cases can take more time then necessary.

The company HTM, which provides total back office management solutions to companies in Japan, performed a small bureaucracy-test in Tokyo and Seattle, the two places where it has branch offices. They looked at the process to register a new company to provide social benefits to employees in Japan. Table 5.15 is the summary of what they found out.

The conclusion is that the process took 8 times longer in Tokyo. This is only an example, but not the only one. The fact that HTM is an American company has influence too. In principle for the waiting time it does not matter whether your company is Japanese or foreign, but in practice this seems to matter after all.

	Tokyo	Seattle
Forms submitted to government	8	2
Supporting documents required with forms	13	0
Meetings required outside of the company	8	0
Hours required outside of the company	13	0
Hours spent gathering and filling out documents	26	5
Total Hours Required	39	5

Table 5.15: HTM research.

Nowadays, changes in the political structure of Japan are making the bureaucracy smaller [93].

The Netherlands

Bureaucracy is a big issue in the Netherlands. Political parties use this subject to recruit more voters. The bureaucracy is especially present in the care-area [92]. A lot of registration needs to happen and there are a lot of rules. This all has the function to control the processes, but it slows them down. The politics are debating about the future of bureaucracy in politics, but it doesn't change very much.

Comparison

Because of the lack of figures that could indicate the amount of bureaucracy in the Netherlands and Japan, a quantitative comparison is hard to make. But a qualitative comparison can be made. The bureaucracy in Japan and in the Netherlands is slow, but the Japanese bureaucracy is more infamous by foreign entrepreneurs.

5.10.6 National factors: human rights and freedom of speech

Human rights are the rights that every human deserves for he or she is a human being. These rights apply for every human being everywhere. Human rights are based on dignity. Amnesty International and the Human Rights Watch are organizations which monitor human rights all over the world. Reporters without Borders, an international organization which applies for freedom of speech all over the world, created the World Press Freedom Ranking. Freedom of Speech is closely related to press freedom and to this ranking. A country without press freedom has a note of 100 in this ranking and a country with press freedom has a note of 0 [95].

Finland, Iceland, Norway and the Netherlands are on the top of this list with a note of 0.50. Russia has a note of 49.50 and has rank 148 and North-Korea has a note of 99.50 and has rank 166.

Innovation is hindered when human rights and freedom of speech is bad in a country. Freedom of press is a basic factor in the creation of knowledge and

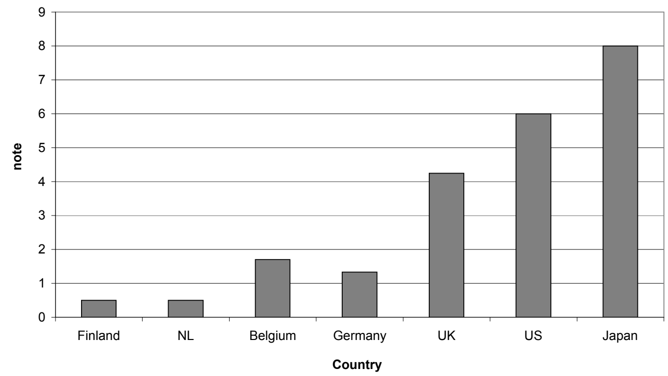


Figure 5.38: World Press Freedom Ranking 2003.

innovation [96].

Japan

The government respects the human rights of its citizens; however, there are problems in some areas. There continued to be some credible reports about police and prison officials physically and psychologically abusing prisoners and detainees. Officials sometimes are dismissed for such abuse but seldom are trialed, convicted, and imprisoned. Violence against women and children, child prostitution, and trafficking in women are problems. Women, the Ainu (Japan's indigenous people), the Burakumin (a group whose members historically are treated as outcasts), and alien residents experience varying degrees of societal discrimination, some of it severe and longstanding. The Ministry of Justice handles complaints of discrimination. However, the Ministry's Human Rights Defense Bureau has a small staff and limited investigative or enforcement powers. The administrative system for combating human rights violations is weak. Many cases end up in court.

The Justice Ministry's Human Rights Commission continued to work on a 5-year mandate to develop measures to educate citizens about the importance of respecting human rights. In July 1999, the Commission submitted a report calling for greater attention to human rights education, particularly at the municipal level. The report also cited a number of ongoing human rights problems, including sexual harassment, violence in the home, and discrimination against the elderly, the disabled, minorities, and foreigners. [97].

The press freedom in Japan is medium and the freedom of speech is so as well. Japan has rank 44 with 8 notes.

The Netherlands

The government generally respects the human rights of its citizens, and the law and judiciary provide effective means of dealing with individual instances of abuse. Problems include violence and discrimination against women, child abuse and discrimination against minorities. The government is taking steps to deal with all of these problems [97]. The Dutch policy for asylum seekers is not completely correct. The problems are:

- Violation of refugee and asylum rights in the accelerated asylum determination procedure;
- Inappropriate treatment of migrant and asylum-seeking children;
- Restrictions on asylum seekers’ rights to basic material support, such as food and housing [98].

The freedom of speech in the Netherlands is high. The Netherlands have rank 1 in the World Press Freedom Ranking.

Comparison

The human rights in Japan and the Netherlands are good, but there are problems in both countries. The freedom of speech in Japan is medium and the freedom of speech in the Netherlands is high.

5.10.7 Conclusion

The research question to be answered is:

> *What are important political forces that support or inhibit innovation on the national level?*

Results are summarized and compared in table 5.16.

Apart from a different electoral system, both governments can be considered equal. The active policies however are not. This can probably be blamed on geographical aspects: the Netherlands having an entire Europe to trade with versus Japan having to fend for itself in not yet developed Asia. It is hard to tell which policy was better since both countries have prospered. Considering the state Japan was in during the pre- and postwar times, it can be argued that Japan had the upper hand. Nowadays however with the latest recession Japan has shifted more and more towards open trade and investment like the Netherlands. But the Netherlands felt the stings of the recession as well, which in the long run hamper innovation since more effort is put in survival rather than innovation.

Some regulations can hinder companies to innovate. Therefore both Japan and the Netherlands are trying to reduce those, giving companies more space to inno-

	Japan	The Netherlands
Historical approach	Protectionistic, domestic	Open trade, investments, competition
Political dependency	Low, bureaucratic	High, political
GERD as percentage of GDP	3% increasing	2%
Government share of GERD	20%	36% decreasing
Innovation policy	Competitive support, increasing funding, reducing regulations	Competitive support, decreasing funding, reducing regulations
Environmental concern	Medium	High
Corruption (scale 0-10)	CPI 7.0 = medium	CPI 8.9 = low
Bureacracy	Slow	Slow
Human Rights	Good	Good
Freedom of Speech	Medium	Good

Table 5.16: Comparison table on national politics

vate. The policies with regard to the public support of R&D are also changing. Support is more and more given as competitive support, also pushing universities and institutes to acquire funding from the private sector. With this competitive support, the governments will (or hope to) get better R&D results for the same price, stimulating the universities and institutes to innovate competitively. These aspects of the Japanese and the Dutch policies are alike. But in the last decade the contribution of the Dutch government to the national GERD is decreasing, whereas Japan is trying to increase its contribution. The Japanese contribution to the GERD is lower than the Dutch share. However, the climate for innovations is better in Japan. Even with a smaller spending on R&D by the Japanese government, it can be said that Japan finds R&D of greater importance than the Netherlands do. But the policies of the Netherlands and Japan are both stimulating innovations, creating a good innovative environment in both the Netherlands as Japan.

Unfortunately however, progress in economy and the environment are more or less incompatible. Even with the Kyoto deadline nearing Japan still showed an increase in CO_2 emissions. Apparently they still choose for economy above the environment. The Dutch on the other hand are starting to show a decline in emissions (although very little), and also stop activities to protect the environment more than just on greenhouse gas, for example not allowing farms or factories near protected areas.

Corruption, bureaucracy, a lack of human rights and a lack of freedom of speech slow down innovation. The corruption in Japan is medium and the corruption in the Netherlands is low. Bureaucracy is in both countries slow. The human rights are in both countries good. The freedom of speech is in the Netherlands better than the freedom of speech in Japan.

5.11 Conclusion

by Bart Spikker

This section will try to give a general answer to the main research question:

How do (socio-)culture differences between Japan and the Netherlands influence innovation?

As said in the introduction in section 5.1 the macro analysis is done with the help of a PEST analysis, historical and geographical research. The results of these complete analysis is repeated below and is split up in three parts. The first part describes the factors discussed earlier as geography, history, socio-culture and technology. The other two parts are the economical and political factors.

5.11.1 Civilization and geographical factors

Geographical aspects like the location, the shape of the countryside and the geographical location have acted as both advantages and disadvantages in building the current Japanese and Dutch civilization. The geography of both countries shows many differences. Civilization developed in different ways on different surfaces. In Japan the mountains, volcanoes and earthquakes caused people to innovate and in the Netherlands the small area and the shallow seas exhorted the people to innovate. In general, it can be said that cultivating a land and coping with its geographical difficulties means you have to innovate, just like Japan and the Netherlands.

From historical point of view every time Japan meets new civilisations with new ideas and technologies, Japan managed to adapt these ideas and technologies to fit in their civilisation. They show a great curiosity towards new ideas, this shows in the way the assimilated new technologies. They assimilate new ideas with a way which made it more efficient. We can see this it in World War II, where they demonstrated their view of a military system.

Other factor is the competitiveness of the Japanese. They felt that they were better then the rest of the world, and treated foreigners as such. This shows in the way they treated the Dutch on Deshima. Everything that was considered better then what they had were evaluated carefully and then assimilated. The competitiveness is shown several times in history; one example is the international commerce that was induced by the government.

Japan has all the demographic properties of high developed country. The employees have highly commitment to work and the management use a very social policy. These factors support innovation. It takes a long time to grow in a company and people that are not suitable for their job can generally keep their position. These factors make it more difficult to have innovation. The main differences between the Netherlands and Japan are religion, management style and the percentage of foreign people.

On technological ground the high research and development expenditures, high skilled employees and Kaizen highly support innovation. This can be seen in the number of patents and the competitiveness ranks. In comparison to Japan the Netherlands invest less in R&D. This is a big competitive disadvantage. The Netherlands and Japan major R&D regions do not differ much.

5.11.2 Economical factors

General economy

A general conclusion that can be drawn from the economical factors is that there is a strong relation between economy and innovation. When economy is flourishing companies tend to invest and to grow larger and larger. These investments can be used for research and development which in turn can lead to innovation. Note that we do not want to claim that research and development and innovation can be seen as the same thing. This in general does not have to be the case. But we can state that a strong economy has a positive influence on innovation. On the other side when an economy is stagnating, investments are postponed and consumers are precautious when spending there money. Therefore it is hard for companies to sell new kinds of products, which inhibits innovation. Companies can still spend money to innovate new products of course, but when they cannot sell these products they will not be tempted to innovate. Also it is hard to increase the amount of products that are being sold, so there is no demand for innovation new, more efficient ways of production. So in short, it can be concluded that economy has a direct influence on innovation.

After decades of miraculous economic growth Japan was hit hard in the recession of the 90s. It is referred to as the lost decade, because the growth in the last ten years is negligible. Major reforms will be carried out in an effort to escape the stagnation and hopes are high that they will be successful. The US has always been a valuable trading partner but in recent years the focus is shifting to the East. Of all the major economies in the world, only China has seen dramatic improvements. If Japan wants to remain a world economic leader it must overcome its historical differences with its neighbor. The general situation in Japan is that currently the economy is growing, however at a very slow rate. The Netherlands have seen a large growth in the 90s but is currently in recession.

Japan is historically a closed nation, both in culture as in foreign relations. After World War II a new foundation was laid on which it prospered to become the second largest economy in the world. Japan has opened up to some extent and improved its trade relations with the US, Europe and the Asian region.

Both Japan and the Netherlands experience recession, but the Japanese recession has been lasting for more than a decade while the Dutch recession started a few years ago. The Japanese and the Dutch economy have shown signs of improvement, but it is not clear if the recent economic growth will continue.

Business cycles describe how an economy is developing and therefore they can also indicate innovation. GDP/GNP is a measure of the size of an economy, so a growth in GDP/GNP usually is followed by an increase in innovation. The GDP/GNP currently is growing with 1% a year and this is quite small for stimulating innovation.

Supporting factors

Japan and the Netherlands both have technology intensive exports with a technology rate as high as one third. Although Japan invests more into R&D, both countries score equal points on the innovation scale. In general innovation is a key element in the international trade of both economies.

Although the GDP of Japan is more than ten times higher than that of the Netherlands, the imports and exports of the Netherlands are still half of that of Japan. Both countries have a trading surplus. The FDIs of both countries are comparable in size, but Japan has mainly investments abroad while the direct investments in and out of the Netherlands are balanced.

Technology and innovation are very important to both economies. The shares of exports that are technologically intensive are about one third for both, but Japan invests more into research and development than the Netherlands does.

A supporting factor for innovation is a lot of trade with many different countries. This improves the delegation of knowledge from those countries to your country. Another supporting factor is the FDI. FDI also lets companies acquire new knowledge from other countries, which they can use in their innovating process. The relatively small amount of FDI in Japan is a sign that foreign companies still have difficulties gaining access to the Japanese economy.

Inhibiting factors

An inhibiting force in international economies are trade barriers. Trade barriers inhibit the flow of innovating products and technologies from other countries into your country. Japan and the Netherlands are both countries that have a large international trading economy. Both use trade organizations to improve free trade on a regional and global scale. Japan as an island is isolated and this is reflected in the difficulty of foreign companies to get access to the Japanese market. The official trade barriers in the form of tariffs have been taken down, although many trade barriers exist on the cultural level and through local laws, however the Japanese government has also began to take down the latter.

Another inhibiting factor is recession. Recession has a similar effect as trade barriers, but now the cause is the declining spending power of countries. They are simply not capable to buy and acquire the innovating goods and technologies.

Interest rates have always been low but are now virtually zero to motivate people to spend their money. The deflation however is inhibiting this effect because money will be worth more tomorrow even with a zero interest level. The lack of demand for product is also inhibition innovation, but the low interest rate should stimulate companies to innovate since funds are cheap. The Bank of Japan is currently enlarging the money supply to dcrease the deflation and maybe even get some inflation and thereby encouraging consumption again.

The unemployment is becoming a problem as well. This causes people to limit consumption since it is uncertain if they will keep their job and thus their income. The income of people with a job has been very stable for the last 30 years and this is a comforting thing for the working class.

5.11.3 Political factors

General Politics

After World War II, Japan became a democracy with a similar structure as seen in most western countries: a parliament (Diet), cabinet and ruler. The government can be seen as a very high prestige company whose job it is to oversee and regulate. Due to this professional attitude Japan in the past thought beyond the conventional ways and employed policies leading straight to improvement and innovation.

Apart from a different electoral system, both governments can be considered equal. The active policies however are not. This can probably be blamed on geographical aspects: the Netherlands having an entire Europe to trade with versus Japan having to fend for itself in not yet developed Asia. It is hard to tell which policy was better since both countries have prospered. Considering the state Japan was in during the pre- and postwar times, it can be argued that Japan had the upper hand. Nowadays however with the latest recession Japan has shifted more and more towards open trade and investment like the Netherlands. But the Netherlands felt the stings of the recession as well, which in the long run hamper innovation since more effort is put in survival rather than innovation.

On both bilateral and multilateral level relationships are important for Japans economic ties and safety which are important for innovation. The bilateral relations are discussed with the relations with other countries and the multilateral are discussed with the international organizations.

Supporting factors

The relationship with other countries changes during the centuries. In 1600 the Netherlands already had relations with Japan, but these relations were lost in 1900 through the new foreign policies of Japan. After World War II Japan became dependent on the United States by the Treaty of Peace. This led to an international politics focus of Japan on its economic market and the relations with surrounding countries for trading.

Japan spends a lot of effort and money in supporting other countries in Asia by joining international organizations like the UN, WTO, World Bank, IMF, Colombo plan and the Asian Development Bank. It also finances organizations like the ASEAN. But another reason for this because it is dependent on the raw materials it gets from these nations and the Japanese government wants a stable, peaceful world economic market.

The Netherlands and Japan are trying to repair the relationship between the two countries by supporting and funding organizations that promote companies of opportunities for exports of goods and technology as well as for investment in the both countries.

A factor which is important for innovation is regional stability. Although Japan is still dependent on the United States for its security and economy, it has become more independent through the years. For resources Japan has become less dependent from Western powers, which can stimulate the production of innovative products.

The policies with regard to the public support of R&D are changing. Support is more and more given as competitive support, also pushing universities and institutes to acquire funding from the private sector. With this competitive support, the governments will (or hope to) get better R&D results for the same price, stimulating the universities and institutes to innovate competitively. These aspects of the Japanese and the Dutch policies are alike. But in the last decade the contribution of the Dutch government to the national GERD is decreasing, whereas Japan is trying to increase its contribution. The Japanese contribution to the GERD is lower than the Dutch share. However, the climate for innovations is better in Japan. Even with a smaller spending on R&D by the Japanese government, it can be said that Japan finds R&D of greater importance than the Netherlands do. But the policies of the Netherlands and Japan are both stimulating innovations, creating a good innovative environment in both the Netherlands and Japan.

All these factors stimulate the companies and organizations of the both countries to invest and to explore their markets to deploy new innovations. Both governments want their markets to trade and invest in a stable economic market.

Inhibiting factors

Some regulations can hinder companies to innovate. Therefore both Japan and the Netherlands are trying to reduce those, giving companies more opportunities to innovate.

Unfortunately, progress in economy and the environment are more or less incompatible. Both countries show detailed plans of how they want to preserve the environment. Those regulations, like on carbon emissions, nitrate or waste production, can and sometimes do severely limit companies in their capacity to function with maximum economic efficiency and thus innovation. The Netherlands promote a somewhat more active environmental regulation than Japan. Even with the Kyoto deadline nearing Japan still showed an increase in CO_2 emissions. Apparently they still choose for economy above the environment. The Dutch on the other hand are starting to show a decline in emissions, and also stop activities to protect the environment.

Corruption can cause several problems on economic, politic and social matters. Innovation can also be hindered by corruption. The Transparency International CPI indexes the rate of corruption of countries. The Netherlands shows less corruption than Japan. Bureaucracy is an important factor in slowing down the making of decisions and the arranging of things. This can affect innovation in a bad way. Japan and the Netherlands have a slow bureaucracy. Freedom of speech and human rights are important factors of innovation. Freedom of press is on the base of creation of knowledge and innovation. Citizens in Japan and the Netherlands are treated in a right way, according the human rights. The freedom of press is high in the Netherlands and not very high in Japan, but not bad. This statement is based on the second World Press Ranking of Reporters without Borders.

Chapter 6

Meso research results

Chapter contents

6.1 Introduction

by Martin Schepers

This chapter describes the meso analysis carried out as part of the research project. The meso level is the direct environment around a company. However, the main interest is in one or more particular divisions or branches of industry. Because the project is carried out by Electrical Engineering student, the focus will be on Electrical Engineering. The meso-level question that has to be answered by means of the research project for each division is:

> *Which fields of Electrical Engineering are of interest in the division and what are hot innovation topics in that division?*

The best known author in the area of division analysis is Michael E. Porter. He has developed several models to analyse an industry or a division, from different points of view. For study tours Porter’s Diamond is the most useful and will therefore be used. The first part of this introduction describes the different aspects of Porter’s Diamond. The second part describes the definitions of the divisions which will be analyzed using Porter’s Diamond.

Something has to be noticed about the exchange rates. In the text, the US Dollar as well as the Japanese Yen is compared to the Euro. The exchange rates of the 31st of July 2004 are being used, unless stated elsewhere. This means the Euro is worth 1.20 US Dollar or 135 Japanese Yen. Furthermore, in some texts, the ECU is being used, which was the previous European currency. At the moment of the introduction of the euro, the ECU was replaced by the Euro at a one-to-one exchange rate.

6.1.1 Porter’s Diamond

Porter’s Diamond, which is shown in figure 6.1, can be used to analyse the competitiveness of a division in a certain country. In order to come with good conclusions the result of the analysis should be compared with the result of the same analysis of a division in a different county. Porter’s Diamond has four basic determinants and two additional variables which are explained below:

Demand: deals with the domestic demand. However, it is necessary to consider the most important facts and numbers of the foreign demand too. Some research has shown that demand influences the shape and speed of changes. Porter distinguishes three different issues within the research of the demand conditions: composition, shape and growth, and the degree to which the domestic demand is representative for the international market.

Factor Conditions: Porter distinguishes two different conditions: ‘basic’ and ‘advanced’. The division can hardly influence the basic factor conditions,

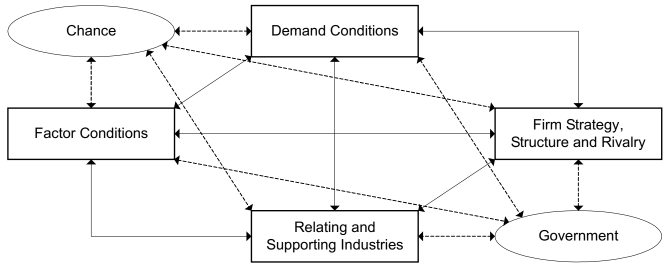


Figure 6.1: Porter's diamond

because they are limiting conditions. The advanced factors however, are created and hardly inherited, they are the flexible limiting conditions that the industries can influence to create a competitive advantage. Porter states that these 'advanced' factor conditions are the ones that contribute the most to the development of a strong competitive position.

Firm Strategy, Structure and Rivalry: deals with the way companies are created, organized and structured. A competitive advantage arises when a company is able to optimally adjust the firm strategy, structure and rivalry to the available resources of a particular country. Porter shows that the level of competitiveness is linked up with the level of innovation and development within a division.

Related and Supporting Industries: deals with the value chain and the presence of related industries. Presence of related industries with a strong competitive position and a strong value chain will guarantee a more attractive industry. Porter's research shows that strong industries are mutually related to each other in so called clusters. A strong division will take along horizontal and vertical related industries in its development. Industries within a strong cluster can take advantage of synergy effects within the integrated cluster.

Government: Porter agrees that the government strongly influences the competitive forces within an industry, which makes research of the government's policy inevitable.

Chance: Accidental circumstances can strongly influence the competitiveness of an industry.

6.1.2 Division definitions

As mentioned before, the focus of this project will be on Electrical Engineering. This paragraph describes which divisions are being used and why. The division classification system ISIC Rev.3.1 [99] is being used and some divisions have been chosen which contain important and interesting technological innovations in the field of Electrical Engineering or describe the innovation process. ISIC is an abbreviation of International Standard Industrial Classification of all economic activities and is defined by the United Nations (UN). The older definitions, such as Rev.2 or 3 had completely different numbers in accordance with 3.1. The selected divisions and underlying classes are shown below:

- From division 31 "Manufacture of electrical machinery and apparatus n.e.c" class:
  3110 - Manufacture of electric motors, generators and transformers;
  3120 - Manufacture of electricity distribution and control apparatus.
- From division 32 "Manufacture of radio, television and communication equipment and apparatus" class:
  3210 - Manufacture of electronic valves and tubes and other electronic components;
  3220 - Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy;
  3230 - Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods.
- From division 33 "Manufacture of medical, precision and optical instruments, watches and clocks" class:
  3311 - Manufacture of medical and surgical equipment and orthopaedic appliances;
  3312 - Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment;
  3313 - Manufacture of industrial process control equipment.
- From division 73 "Research and development", class:
  7310 - Research and experimental development on natural sciences and engineering (NSE).
- From division 80 "Education" class:
  8030 - Higher education.

In this chapter, each section tries to answer the research question for one of the above mentioned divisions. The sections start with a description of the division to be analyzed and after that, each determinant of Porter's Diamond is discussed for Japan as well as the Netherlands. Furthermore, each section describes some hot innovations in the field of the discussed division. The sections are all finalized with a comparison and a conclusion. The chapter ends with an overall conclusion.

6.2 Division 31

by Paul Omta and Niek Bouman

6.2.1 Introduction

This section describes division 31, the division of "Manufacture of electrical machinery and apparatus n.e.c.", and it will cover the innovation in classes 3110 and 3120 of the ISIC Rev.3.1 class definitions [99]. Officially these classes are defined as:

3110 Manufacture of electric motors, generators and transformers;

3120 Manufacture of electricity distribution and control apparatus.

It should be noted that information on this division is hard to find, because the European Union has not done much investigation on this division. The amount of investigation on this division in Japan is even worse. Furthermore not much information has been found on related and supporting industries. Of course the companies depend on other companies for some of their parts, but the dependence on other industries was found to be low and the factor has therefore been left out.

Another point that has to be mentioned is that the economical comparisons are done at prices and exchange rates of 1990.

First, both classes will be analyzed with Porter's Diamond and Japan will be compared to the Netherlands. This analysis will be based on data from 1987 to 1996 [100]. The reason for this is the fact that this was the only period on which a lot of data was freely available. It should be noted that the Netherlands are a small player in this field. For the EU, Germany (37%) is the largest producer of electrical equipment, followed by France (15%), Italy (14%) and the UK (11%) [101].

Second, two innovation topics will be highlighted, being: electric motors with permanent magnets and solar cells.

The section furthermore contains some general data until 2002 [102], [103] and it ends with a comparison and a conclusion.

6.2.2 Demand

Within the research of the demand, several aspects can be distinguished. The following demand aspects will be discussed for Japan as well as the Netherlands: domestic market, production, import and export. Furthermore, in the case of Japan, employment is taken as a demand aspect. Employment might not be a demand condition, but it does give some indication to the size of an industry, which will be discussed below.

Japan

The varying growth in the two halves of the observation period is reflected in employment number which rose from 617,000 in 1987 to 694,000 in 1991, falling thereafter to 590,000 in 1996.

The two growth phases in the observation period have two basic causes. Up to 1991 the Japanese economy experienced favorable economic conditions with booming domestic demand and strong exports with a slightly undervalued Yen. Since the beginning of the 1990s, the Japanese economy went into stagnation and recession. The crisis led to a considerably lower utilization of production capacities and thus to cost increases, which in turn caused a lower demand. The result was that investment activity, on which most product groups in this investigation depend, declined. The Japanese industry was unable to offset weak domestic demand with exports. In 1993, 1994 and 1995 the Yen strengthened considerably and the industry's price competitiveness weakened. Not until 1996 there was a devaluation, but it has not yet led to a return of the export-boosting exchange rate at the end of the 1980s and the beginning of the 1990s.

The domestic market volume of the Japanese electrical engineering industry absorbed about 90%, with little fluctuation, of Japanese production during the observation period. The main impulses were thus released by domestic factors and has two causes. On the one hand, the stronger employee attachment to Japanese enterprizes, expressed in relatively weaker employment reduction in comparison to the EU, deprives Japanese enterprizes of the option of achieving necessary cost reductions by reducing personnel. On the other hand, no compensation was achieved by higher profits from customer prices even though Japanese firms evidently succeeded in dampening price declines in the 1990s somewhat.

Between 1992 and 1996 Japanese domestic consumption declined at a yearly rate of 0.6%. In the EU it rose by 0.8%. This weak domestic demand had little dampening effect on imports which, at an average annual increase of 18.8%, grew at an only slightly more weaker pace than during the previous five years. Foreign suppliers increased their market share during the observation period from 2.2% to 7.3%. This share is still much lower than the import penetration rates of the EU (19%).

The Japanese export ratio rose during the observation period from 13.2% to 18% and was also lower than corresponding shares in the EU (1996: 22.5%). During the whole observation period exports clearly outweighed imports. In 1996 exports were three times as high as imports, the absolute surplus during the period rising from 7 billion Euro to more than 12 billion Euro (figure 6.2).

About 85% of Japanese electrical engineering production went to non-EU countries, especially America and the Asian NICs. Trade links with EU countries are weak, measured in terms of market size. Whereas in 1987, 14% of all Japanese exports went to the EU, this share increased in 1996 to nearly 15%.

In the case of imports the development was even more unfavorable for EU suppli-

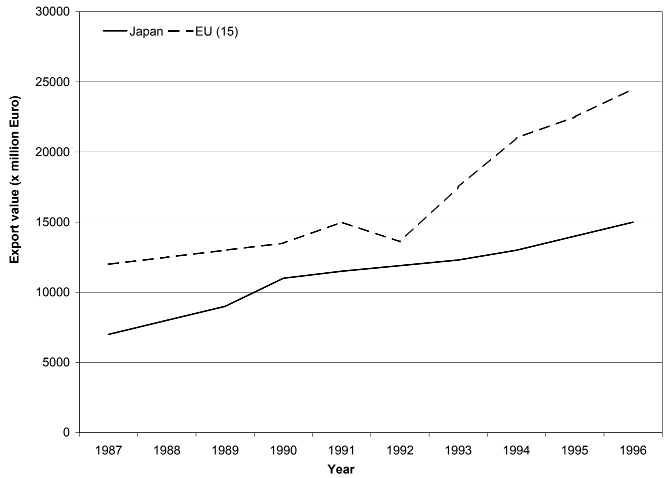


Figure 6.2: Export of division 31 for Japan compared to the EU.

ers. In 1987 Japan's imports from EU countries amounted to 21% which declined to less than 13% in 1996. Japan's trade surplus with the EU in electrical engineering products doubled accordingly from 0.9 billion Euro to nearly 2 billion Euro.

The Netherlands

Between 1987 and 1996 Dutch production of electrical engineering products rose at a yearly rate of 5.2%. This was much stronger than the EU average of 3.4%. This better development was caused by continued high growth rates during the 1990s when production in most other EU Member States was strongly affected by the recession (see figure 6.3).

It was attributable to a more favorable domestic demand which grew even stronger between 1992 and 1996 than the preceding years: at a yearly rate of 7.5%. The Dutch manufacturers of electrical engineering products have been able to take full advantage of the strong domestic demand and imports grew roughly at the same rate. It is of note that imports from other Member States increased by less than 5%, whereas imports from third countries grew by around 15% in the years after 1992. A noteworthy share of these imports is attributable to Dutch manufacturers themselves, because these goods originate in their own facilities abroad and from foreign subcontractors.

In the past there was strong domestic demand for electrical engineering products from shipbuilding and the aircraft industry (Fokker). These clients required specific high performance components, which gave an advantage to Dutch suppliers. Much of this demand was lost during recent years, so the domestic growth outlook worsened. Some of these companies have increased their export efforts and in the business area of cable harnessing for the aircraft and space industry Dutch

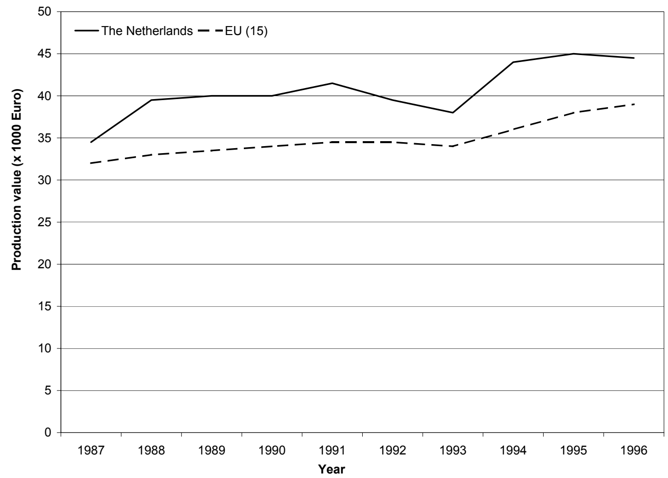


Figure 6.3: Production of division 31 for the Netherlands compared to the EU.

manufacturers play an important role.

Dutch exports of electrical engineering products expanded less dynamically. Between 1987 and 1996 their share of EU exports shrank at a yearly rate of 6.2%. The yearly rate for the EU was 8.5%. While the Dutch contribution to EU production is around 2%, only its share of imports is well above 8% and around 5% for exports. Traditionally the Netherlands have experienced a deficit in trade with other countries. To a certain extent the trade deficit is due to the particular situation of the Netherlands as a transportation hub. Many products from third countries enter the EU via the Netherlands and are distributed to other EU Member States instead of selling products which are produced inside the Netherlands. Even some of the imports of electrical engineering products are intermediary goods and leave the country as non-electrical engineering goods, e.g. Polaroid imports batteries which are being built in film cartridges and this final product is exported.

Demand for products in NACE 3110 group is, on the one hand, closely related to manufacturing processes and the investment in the manufacturing industry and in the whole economy. On the other hand, it is related to the growth of electricity consumption, for example generators and the improvement in power distribution and transformers. The European Union is, at the moment, liberalizing the energy market. This would change the way contracts are made. Perhaps the overcapacity in the multiple energy providers will provide a greater demand in generators and similar products.

6.2.3 Factor conditions

This paragraph discusses the most important factor conditions, such as productivity, the level of wages and the labour costs for Japan as well as the Netherlands.

Japan

Productivity in the Japanese electrical engineering industry, measured by value added per employee registered strong growth averaging at a yearly rate of 7.8% between 1987 and 1992. This meant a doubling in less than ten years. In the subsequent years the productivity increase flattened out to 4.4%, but the growth was still twice the EU growth. For the entire observation period the Japanese electrical engineering industry recorded a productivity increase averaging at a yearly rate of 6.3% compared to only 2.4% for the EU (figure 6.4). Because of the high increase in productivity in the Japanese electrical engineering industry and the moderate increase in wages, the development of unit labour costs was more favorable in comparison to the EU. The increase of productivity at moderate increase of wages were necessary to meet the challenge of the declining prices.

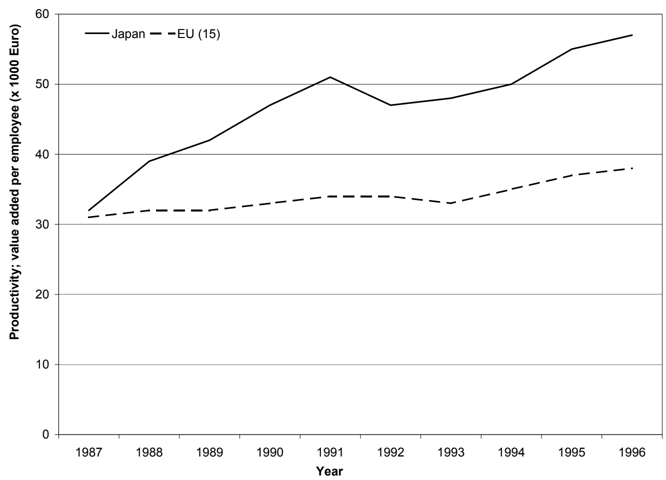


Figure 6.4: Productivity of division 31 for Japan compared to the EU.

The Netherlands

The labour productivity of the Dutch electrical engineering industry achieved a value of 44,700 Euro in 1996, which was more than one tenth higher than the EU average. Productivity grew more strongly, at a yearly rate of 3.0% between 1987 and 1996, against an EU average of only 2.4%. With regard to the growth of production, which showed a much higher momentum for the Dutch electrical engineering industry compared to the EU from 1992 (figure 6.5). The increase of productivity must be evaluated as low, because an expansion of output usually provides productivity gains.

Although the Dutch productivity is higher compared to the EU productivity, the gross operating rate - an indicator of the evolution of profit - is only average and shows a similar tendency. The major explanation is provided by the wage level which in 1996 reached 31,700 Euro per employee and year, and is 15% higher

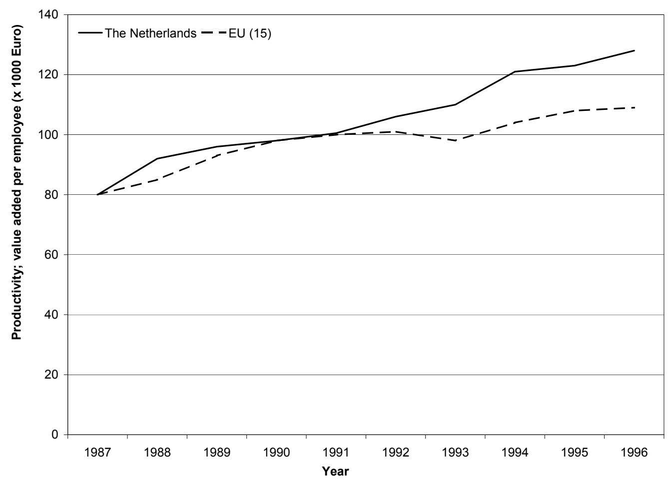


Figure 6.5: Productivity of division 31 for the Netherlands compared to the EU.

than the EU wage level. The Dutch electrical engineering industry's investment expenditure has expanded at a yearly rate of 3% during the observation period, which was slightly higher than for the EU.

6.2.4 Firm strategy, structure and rivalry

This paragraph is about firm strategy, their structure and rivalry between firms and describes factors like the production volume, innovation activity, R&D spending and the number of patents.

Japan

The production volume of the Japanese electrical engineering industry was 107 billion Euro in 1996 and was 13% lower than the output of the EU. Because of the strong devaluation of the Yen which began in 1996 the importance of the Japanese industry is under-represented. Figure 6.6 shows the production in NACE division 31.

It is noteworthy that during all of the observation period, Japanese prices for electrical engineering products decreased. A tendency which has also been observed for other manufactured goods in Japan. For the years under investigation it grew at an annual rate of 4.1% in comparison with 5.6% for the EU.

The comparison of the structure of the Japanese and the EU firms shows only little difference between divisions. As in the EU, where the class "electricity distribution and control apparatus" (NACE 3120) has a 34% share of total volume, the class also dominates in Japan with a 31% share. In second place is the class "electric motors, generators and transformers" (NACE 3110) with a share of nearly 17%,

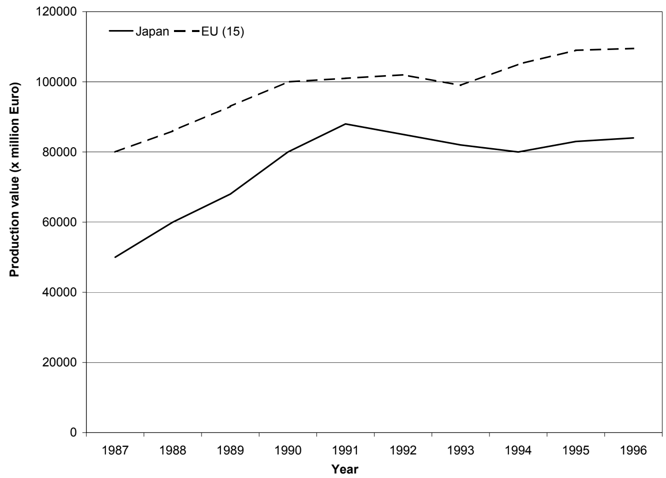


Figure 6.6: Production of division 31 products for Japan compared to the EU.

which corresponds to that of the EU.

A difference can be found in innovation activity (figure 6.7).

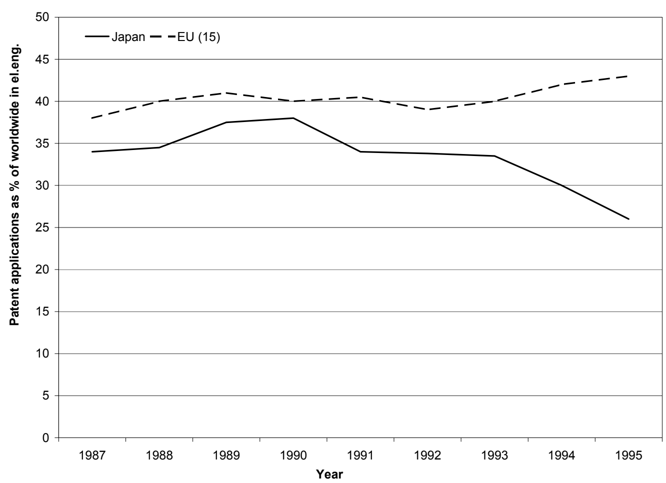


Figure 6.7: Innovation activity of Japan compared to the EU.

R&D spending, which was also aimed at future survival, developed at a relatively constant proportion to production in the Japanese electrical engineering industry. At the beginning of the observation period, the rate was 5.2% and in the following years there was little fluctuation. It was about one percentage point above the figure of the EU for the observation period.

The peculiar thing is that even though R&D spending was proportional to the production, this is not shown in the amount of patent applications. Since the crisis in 1990, the percentage of patent applications in Japan has dropped significantly (figure 6.7).

The Netherlands

The Dutch electrical engineering industry reached a production value of more than 2.9 billion Euro in 1996. This equals 2.4% of total EU output. The electrical engineering industry of all Dutch manufacturing industries accounted for 1.3% of the employment in 1996 and was well below the EU average of 3%, although one of the world's biggest suppliers in this industry, Philips, is from the Netherlands.

But in fact this company is a global player with an international production and distribution network, although its headquarters are located there. During the past decade the Dutch electrical engineering industry experienced a major change. Many of the national suppliers lost their independence and were taken over by foreign competitors, among them Holec, the biggest Dutch group beside Philips. It suffered an economic setback and was dismantled. The individual companies were sold, such as the business area of switching gears which was acquired by the Austrian Elin.

Dutch industry enjoyed a higher growth momentum than most other EU member states. However, the investment activity is only at the EU average. Investment intensity, which stands for the expenditure per employee, amounted 5,500 Euro in 1996 and was only 10% above the EU average.

There is no available information on Dutch R&D expenditure. The innovation activities which are indicated by the number of important inventions with patent applications in at least two countries, reveal a much higher intensity for the Netherlands than for the EU. In 1987 patent applications were filed for more than 90 important inventions per 1 billion Euro production in the Netherlands. This is three times the figure for the EU. Although for an interim period there was a drop in the innovation intensity, Dutch activities have remained at a much higher level (figure 6.8).

6.2.5 Government

Country experts of the Netherlands have reported some problems with regulations. Although the IEC standard is applied in all EU member states, there are further national regulations which hamper market access. Moreover, there is a French and a German standard on bus technology which are both supplied in the Netherlands and threaten the compatibility of systems.

Something to be taken into account is the liberalization of the energy market. The industry of NACE division 31 can profit from this fact enormously, which has been explained in the paragraph about demand.

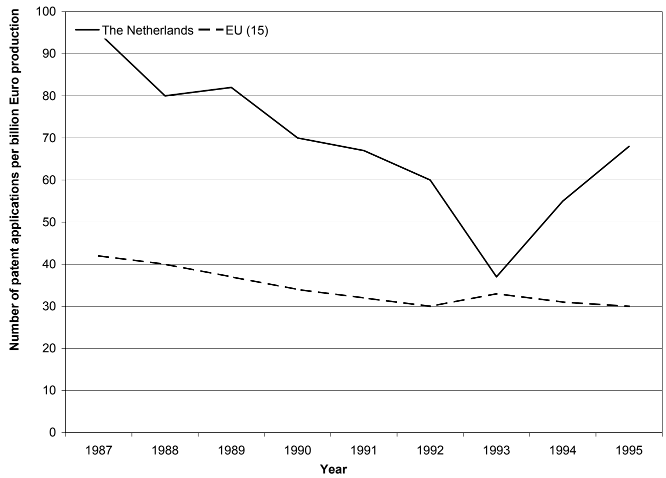
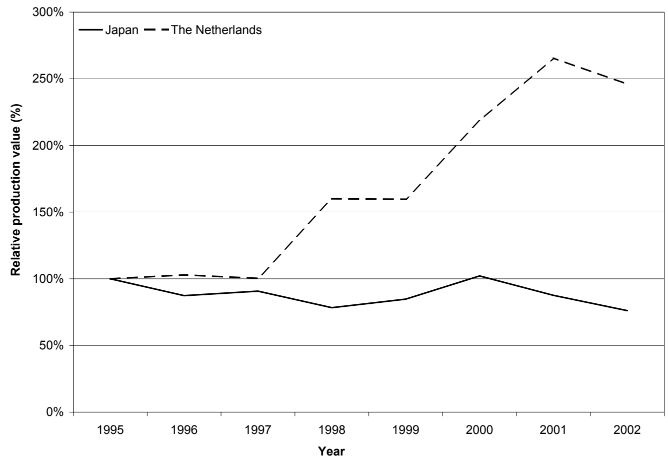


Figure 6.8: Innovation intensity of the Netherlands compared to the EU.

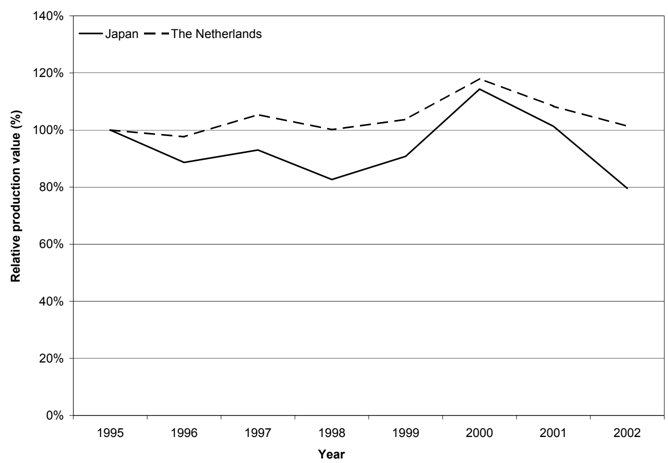
6.2.6 General data

All data is taken from [102, 103]. Interesting trends on production values are plotted in figure 6.9 and on export rates in figure 6.10.

As can be seen from the graphs shown in figure 6.9 and 6.10, the Netherlands have seen an enormous increase in production in the division 3110 over the past few years. Perhaps this is due to the liberalization of the energy market. Something to note about the export figures is that the Netherlands export more than it produces. This is due to the fact that the Netherlands is a trade-hub, in which a lot of products travel through. Which part of the produced products are exported is unknown, but it would seem that there is a big enough market for division 31 products if the Netherlands were able to produce more.

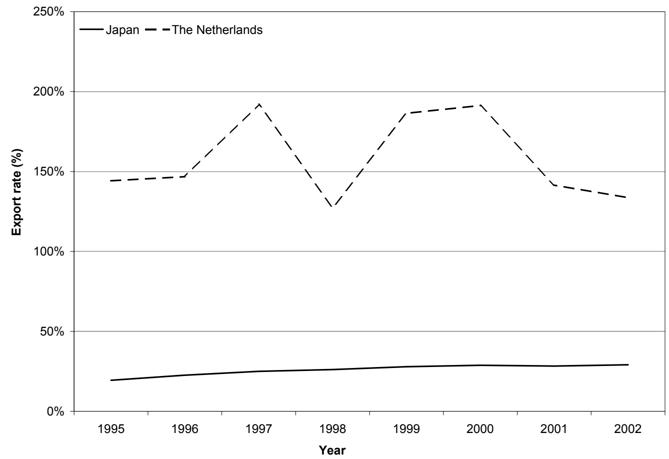


(a) Production of division 3110.

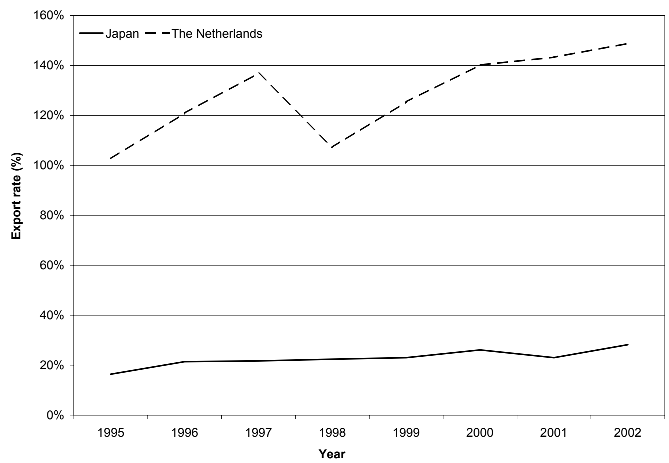


(b) Production of division 3120.

Figure 6.9: Production for the analyzed divisions in Japan compared to the Netherlands.



(a) Export of division 3110.



(b) Export of division 3120.

Figure 6.10: Export rates for the analyzed divisions in Japan compared to the Netherlands.

6.2.7 Hot innovations

In this section, two recent innovations which belong to the electric equipment division (NACE 31) are presented. Both innovations play an important role in Japan as well as in the Netherlands. The first topic of discussion is in the field of electric motors. The usage of permanent magnets in these motors results in a high efficiency over a wide speed range. Because of this, this type of electric motor is used in new applications. The second topic comprehends the innovations in solar technology. Although this subject does not belong to NACE classes 3110 or 3120, the subject is discussed here because during the study-tour there will be a visit to Shell Showa in Tokyo, a manufacturer of photovoltaic cells and modules.

Permanent magnet electric motors

The asynchronous electric motor has been the industry's workhorse for a long time. Inside this motor, an electromagnetic field is generated by coils. However in recent years, the advantages of motors with permanent magnets in various applications have been discovered. In the past, permanent magnets had only been applied in small one-phase motors, but nowadays they are also used in high power applications [104].

The main advantage of electric motors with permanent magnets is the high efficiency over a wide speed range. Therefore direct driving, without a gearbox, is possible. Without gear wheels, not only less energy is consumed, but also the entire propulsion system takes up less space [105].

Stronger permanent magnets allow for higher-efficiency motors to be produced. Recent improvements in the properties of neodymium-iron-boron (NdFeB) magnets have made the replacement of ferrite magnets attractive in certain applications. Currently, NdFeB is the most powerful magnetic material at room temperature available, with high values of flux density at very high values of magnetization. It is also extremely resistant to demagnetization. Furthermore NdFeB is less expensive and less fragile compared to samarium cobalt, another rare earth material widely used in the 1980s. Although the development of NdFeB magnets has had a significant impact on the electric motor industry, these advancements have gained little acceptance from the automotive division because of the higher cost of NdFeB compared to ferrite. Continuous price reductions in NdFeB magnets are finally enabling the replacement of ferrites in many high-volume applications [106], [107].

All the above mentioned benefits have recently boosted the development of innovative applications for the permanent magnet motor throughout the world. Especially in the automotive division, good Japanese and Dutch examples exist.

Examples in Japan

A nice Japanese example of the permanent magnet motor innovation is the hybrid car. Such a car contains, besides an ordinary combustion engine, an efficient electric motor. This combination results in less fuel consumption and therefore a decrease in emission of exhausts.

Launched back in 1997, Toyota's Prius was the first hybrid car on the market. Recently, the second version of the Prius (Prius II) has been launched. Toyota recommends its Prius II as a mid-range business car. It accelerates from 0 to 100 km/h in 10.9 seconds and has a top speed of 170 km/h. The average fuel-consumption is a remarkable 1 liter per 20 km and the CO_2 emission is limited to approximately 100 grams per kilometer. These economical characteristics arise from the combination of a 1.5 liter gasoline combustion engine (57 kW and a torque of 115 Nm at 4000 rpm) and a 500 Volts, 50 kW synchronous electric motor with neodymium magnets, which delivers a continuous torque of 400 Nm. The power of the gasoline engine and the electric motor is combined and delivered to the drive-shaft via a complex planetary epi-cyclic gear system.

Besides Toyota, Honda is also a pioneer in the hybrid market. In its hybrid car, the Civic IMA (Integrated Motor Assist), a permanent magnet electric motor (144 Volts, 10 kW, 160 Nm) is completely integrated with the combustion engine (61 kW) and is therefore very compact (figure 6.11). Furthermore, the Civic IMA has an ordinary gearbox. Unlike the Prius, the Civic IMA cannot drive purely on the electric motor. Honda's IMA system is less complex, but the fuel consumption is a little less economic: 1 liter per 19 kilometers.

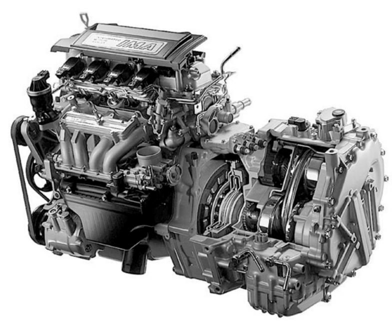


Figure 6.11: The Honda IMA hybrid engine.

Both cars have a functionality that is called regenerative braking. This means that the electric motor can operate as a generator to utilize braking energy. An interesting energy-efficient technique from Honda is the disabling of the valves of three of the four cylinders during braking. This results in less friction from the engine and gives the generator the ability to regain 57% instead of 37% of the braking energy [105, 108].

Examples in the Netherlands

Besides Japan, in the Netherlands also various innovations exist that are based on the permanent magnet electric motor. A nice example is the new city bus in Apeldoorn, which was launched in October 2003. This bus has no gasoline combustion engine, but is driven by electric motors that are mounted inside the wheels. Due to the use of permanent magnets in these motors, the wheels are driven directly, without a gear system. Because of its silent operation, the bus is called “The Whisper”. As well as the Japanese hybrids, the Whisper is able to regain braking energy by using the motors as generators [109]. One of the wheel-motors of the bus is shown in figure 6.12. A company called “E-traction” has developed these wheel-motors. Meanwhile, not only the Whisper, but also a Sports Utility Vehicle (SUV) and a fork-lift truck have been successfully equipped with this new type of motor [110].

Figure 6.12: A wheel of the Whisper city bus.

Another beautiful example is the permanent magnet wind turbine from Zephyros, a company established in Amsterdam. This 2 MW turbine is built around a 4000 Volts generator with permanent magnets. The rotor, which turns at a speed varying from 15 to 25 rpm, drives the generator directly. Just like some previous examples, a higher efficiency is yielded because a gear system is lacking. In April 2002, the first Zephyros based on a permanent magnet generator has been placed on “De Maasvlakte” [104].

Solar technology

Photovoltaic (PV) solar electricity is a very elegant method to produce electricity without moving parts, emissions or noise and it is all done by converting abundant sunlight without practical limitations. Some decades ago, this technology was only used in space applications. Nowadays, as a result of technical developments and government funding programs, photovoltaic technology has become a popular and fast-growing market. Currently, Japan is the world’s biggest producer of solar cells and modules. Therefore it is very interesting to look at solar technology within the framework of Shouraizou. The Netherlands is not a producer of solar cells or modules, yet research in this field is carried out. In both countries, PV innovation becomes more and more visible, for example on top of buildings and houses. This section is organized as follows. First, different types of PV technology are discussed. Then, PV technology is regarded from a market point of view. The section ends with solar innovation examples in Japan and the Netherlands.

Photovoltaic cell technologies

Nowadays, multiple PV cell technologies exist. The most important being crystalline silicon and thin film cells. Two types of crystalline silicon can be distinguished: mono- and polycrystalline silicon. PV cells made from polycrystalline silicon have become popular as they are less expensive to produce, although slightly less efficient compared to monocrystalline cells. The maximum recorded cell efficiency for crystalline silicon is 24.7%. Cell efficiencies higher than 25% have been recorded for cells made from III-V semiconductor material, but because of their high costs these materials are only used in space applications.

Thin film modules are constructed by depositing extremely thin layers of photovoltaic materials on a low cost backing such as glass, stainless steel or plastic. Individual 'cells' are formed by scribing through the layers with a laser. Thin film cells offer the potential for cost reductions. Firstly, material costs are lower because much less semiconductor material is required. Secondly, labour costs are reduced because the films are produced as large, complete modules and not as individual cells that have to be mounted in frames and wired together.

The most fully developed thin film technology is hydrogenated amorphous silicon. This is the material normally used in consumer applications, although it is, less frequently, also used in power modules. The efficiency of commercial amorphous silicon modules has improved from around 3.5% in the early 1980s to over 7% at present [111]. It must be emphasized however that the different technologies will coexist, even though their efficiencies may be quite different. The same holds for their costs per Wp or per square meter. (The unit Wp is by definition the power which a solar module yields at a 'peak' irradiation of 1,000 W/m^2 at standard test conditions). If, for example, a customer needs high power output from a limited area (laptop, sun roof, etc.) he is prepared to pay a high price per Wp whereas the price per area is not important. However, if for a skyscraper wall 10,000 m^2 can be covered by PV modules, it becomes quite obvious that a low price per square meter is more important. Figure 6.13 shows some relative prices and performances of different PV technologies [112].

Market and production

The global photovoltaic market has grown approximately at a yearly rate of 33% in the period from 1998 to 2002 and has reached approximately 450 MWp in

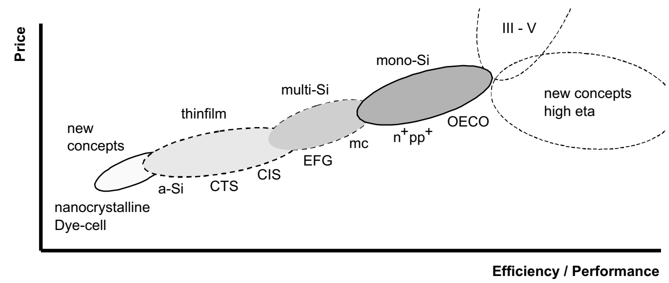


Figure 6.13: Relative prices and performances of different PV technologies.

2002, likely to have reached 600 MWp in 2003. Whereas the market in the past developed basically from consumer products and remote industrial applications, the contributions of the market segments have shifted towards grid-connected systems, followed by installations in developing countries. Further growth of these market segments is extrapolated up to 2030 in figure 6.14 [112].

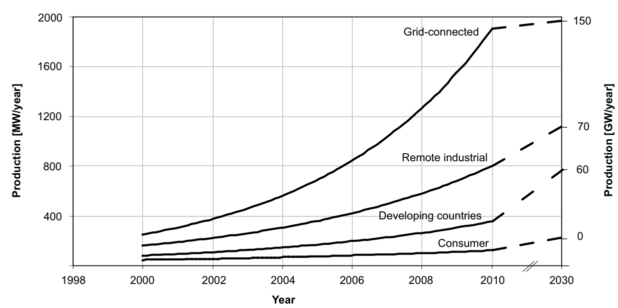
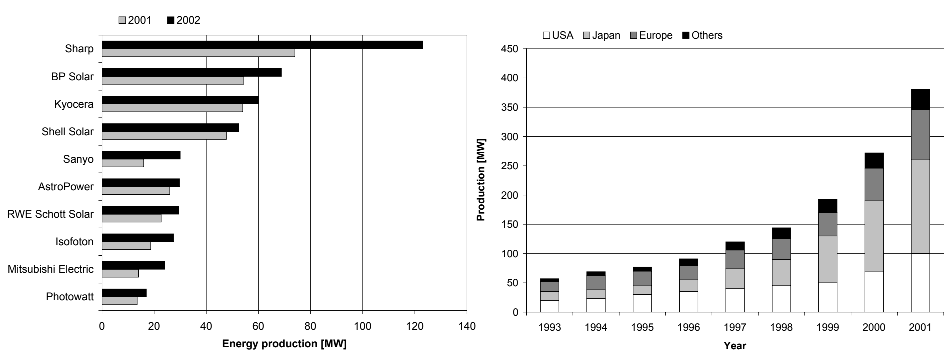


Figure 6.14: Expected PV market growth.



(a) Top ten of PV producers in the world. (b) World production of PV modules.

Figure 6.15: Japanese dominance in the PV market.

Figure 6.15a shows the world-wide top ten of PV producers in 2001 and 2002, and figure 6.15b shows the world production of PV modules up to 2001. The Japanese dominance is clearly visible in these graphics. One of the reasons Japan achieved this solar prominence can be attributed to the uninterrupted federal assistance, which has been afforded mostly by the very influential Ministry for the Economy, Trade, and Industry (METI). Due to this funding, the Japanese have been able to build up a self-supporting market. A good example of funding is the residential "70,000 Roofs" program, in which METI has been promoting the installation of solar power systems on private rooftops. The federal government's goal is to build up to 5 gigawatts of maximum solar output by the year 2010 [113]. Table 6.1 shows a roadmap for the Japanese PV market up to 2030, obtained from the Japan Photovoltaic Energy Association (JPEA). In order to compare Japan with the Netherlands with respect to the PV market, it is useful to compare the cumulative installed power in both countries which are shown in figure 6.16. In 2002, the cumulative installed power per capita was a world-leading 5W in Japan against 1,64W in the Netherlands [111].

	2010	2020	2030
Annual Install. (MW)	1230	4300	10000
Residential	830	1950	2800
Public	105	600	1000
Industrial	195	930	2500
Overseas	100	800	2500
Cummulative Install. (MW)	4820	28700	82800
Market size (billion yen)	473	1250	2250
Oil reduction (billion liters)	1.2	7.2	20.7
System costs (yen/Watt)	300	250	<200

Table 6.1: Japanese roadmap for the PV Market.

Examples of PV innovation

With such a high amount of installed power per capita, it is not difficult to find PV examples in Japan. During the study tour, a visit will be paid to NTT Do Co Mo. The headquarters of NTT Do Co Mo in Tokyo, the "Yoyogi" building, has a PV system. Solar cell panels are installed vertically in the spandrel part of the slit windows of the south elevator shaft and also in the side of the steel tower on the roof [114].

Another very exceptional example is Sanyo's "Solar Ark", located in Anpachi town, Gifu prefecture. Belonging to the philosophy of contributing to the advent of a clean energy society, the Sanyo Electric Group has built this very large solar power generation system (figure 6.17). The facility's power generation capability is 630 kW [115].

In the Netherlands, also many PV examples exist. Very interesting is the HAL project, an initiative of the cities Heerhugowaard, Alkmaar and Langedijk. One of the goals is to build the 5 MW "City of the Sun" solar project. In total, 50,000m^2 of solar modules will be installed, which has to be completed in 2005. Figure 6.18 shows an example of a house in the "City of the Sun" [116].

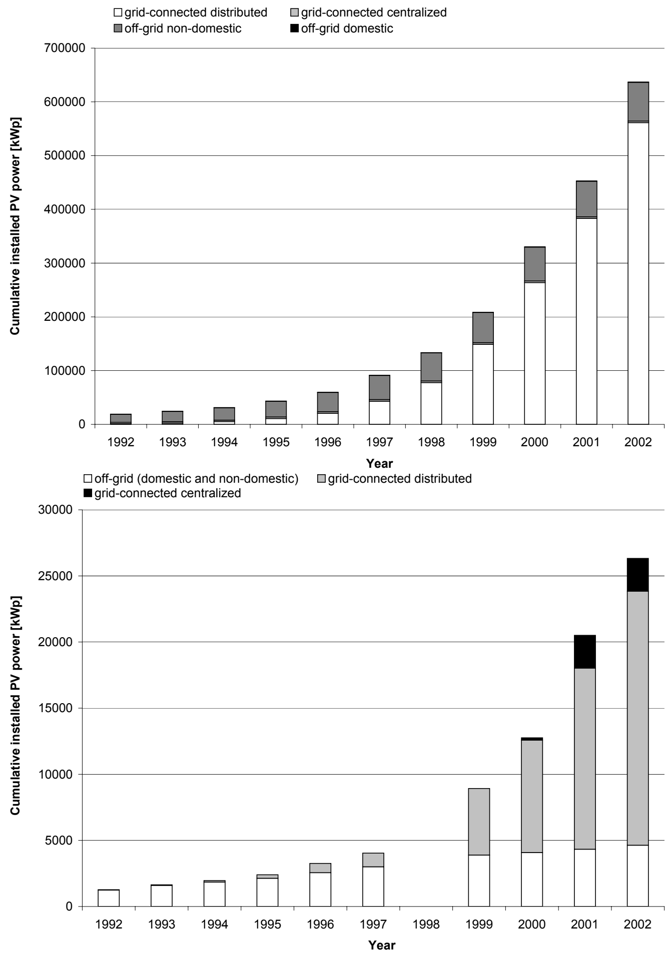


Figure 6.16: Cumulative power installed in Japan and the Netherlands.

Figure 6.17: Sanyo’s Solar Ark.

Figure 6.18: Houses in Langedijk with PV modules mounted on the roofs.

6.2.8 Comparison and conclusion

This paragraph shows a comparison between Japan and the Netherlands as a result of the analysis with Porter's Diamond. The comparison shows the differences in production, export, productivity and innovation activity.

	The Netherlands	Japan
Production	The increace in production over the last few years would suggest that there is potential in this industry.	Production dwindling slowly.
Export	Very high export, but also very high import. This is due to the fact that The Netherlands is a trading hub.	Some export, about a quarter of the produced wares.
Productivity	Dutch employees show less added value that their Japanese colleagues.	Japan shows a greater productivity.
Innovation activity	More patents are requested than in Japan, which would suggest that The Netherlands is more innovative.	Less patent activity, even though investment rates are more or less the same as in The Netherlands.

Table 6.2: Comparison table on division 31.

Even though Japan produces about a factor 200 more products in the divisions under review, a comparison can still be made on a relative scale. The production in division 3110 is growing quickly in the Netherlands. It is by far not near the size of the Japanese production, but an increase of 250% cannot be neglected.

On export not much can be said, because the Netherlands export more than they produce. This is due to the fact that the Netherlands are in fact a trading hub, with high imports and exports. Perhaps there is some value added, but this is not sure. However due to the different situations, the Netherlands cannot be compared to Japan on this subject.

The productivity in the Netherlands is a little lower than in Japan. The cause of this might be that Dutch workers are expensive workers. The situation in Japan is, in this respect, a bit more favourable.

Innovation activity shows something different. In recent years the trend has been that the Netherlands request much more patents compared to Japan. Some people claim this is changing and that Japan is nowadays on the same technological level as the EU and the US. Perhaps the level of technology is higher in Japan, which might be told in later studies. Considering the subject of innovation activity, it can be concluded that results from the past cannot guarantee results in the future.

A hot innovation in division 31 is the emergence of the electric motor with permanent magnets. In Japan, as well as in the Netherlands, many examples of this innovation exist. With respect to solar technology, Japan is the world's largest producer of photovoltaic cells and modules. Additionally, when looking at the cumulative solar power installed per capita, Japan is again the world's leader. This leading position comes mainly from intensive government funding programs.

6.3 Division 32

by Pieter Cuperus, Kasper van Zon and Thomas Janson

6.3.1 Introduction

This section describes division 32, the division of "Manufacture of radio, television and communication equipment and apparatus" and it will cover the innovation in classes 3210, 3220 and 3230 of the ISIC Ref 3.1 class definitions [99]. Officially these classes are defined as:

3210 Manufacture of electronic valves and tubes and other electronic components;

3220 Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy;

3230 Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods.

This section first discusses all different factors of Porter's Diamond, after which the comparison and conclusion will be given.

6.3.2 Demand

An important factor to an industry that pursues innovation is good market characteristics. Therefore the demand of the concerning industry is explored in this section. Porter argues that a sophisticated domestic market is an important element to producing competitiveness. Firms that face a sophisticated domestic market are likely to sell superior products because the market demands high quality. Moreover, close proximity to such consumers enables the firm to better understand the needs and desires of the customers. Furthermore, the worldwide demand characteristics for the concerned products are of great importance. With increasing globalization the composition of sales of companies gradually shift from inland to the world market. On top of that, the discussed products are luxury goods, which tend to have a more global market.

Japan

Japanese consumers are known for their attachment to and rapid adoption of gadgets and new technology. Devices are treated as consumer goods rather than technology items, which makes them more trend-based. This results in a relatively fast changing demand that stimulates innovation. In table 6.3 as well as in figure 6.19 the production of electronics in Japan in the first part of 2004 can be seen, which also is a representation of the worldwide demand composition. Striking is that the production of video-equipment in Japan is more than 30% higher than in the same period of the previous year. Taking into account that sales figures for

DVD players and recorders, digital (video) cameras, and LCD television sets have each grown enormously, this difference in the video division can be explained to a large extent. The popularity of LCD screens can also be seen in the growth of production of LCD devices (the LCD components that are used in LCD screens).

	February 2004		2004 total to date	
	Million ¥	%	Million ¥	%
Consumer electronic equipment (CE)	181.177	124,1	332.847	120,2
Video equipment (CEA)	158.787	136,0	288.721	131,3
Audio equipment (CEV)	22.390	76,6	44.126	77,4
Industrial electronic equipment (IE)	674.383	101,6	1.281.642	102,3
Electronic application equipment (IA)	73.918	104,3	136.663	109,8
Electronic components and devices (ED)	802.178	114,1	1.596.324	114,8
Integrated circuits (IC)	293.362	110,5	592.650	112,0
Liquid crystal devices (LCD)	150.442	139,3	290.713	140,1
TOTAL	1.657.738	109,5	3.210.813	109,9

Table 6.3: Production of electronics in Japan.

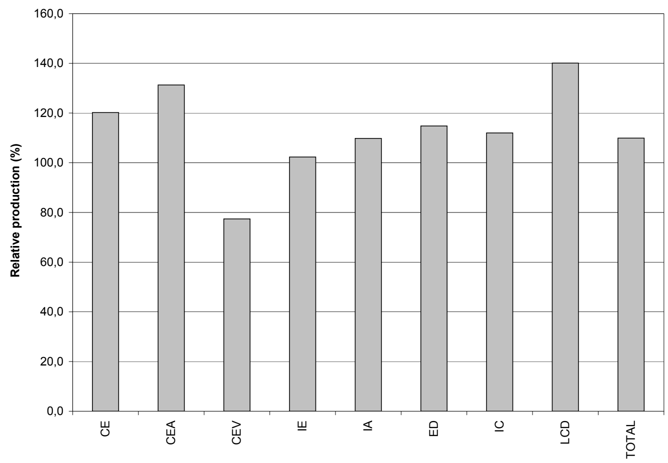


Figure 6.19: Production of electronics in Japan (2004).

The Netherlands

Whilst not as influenced by trends within the consumer device market as Japanese people, Dutch consumers still respond enthusiastically to new gadgets. Dutch consumers are therefore not early accepters of new technology, but will respond to it some time later. The demand of Dutch consumers thus follows the characteristics global demand with some delay.

6.3.3 Factor conditions

An important factor of being competitive on the world market is having low priced products. Logically, to be able to sell products at a low price, the production costs have to be low. A large part of these production costs are the wages of the labour-force. When discussing the level of the wages, also the productivity of the labour-force has to be taken into account. The figures of the productivity in the two countries concern the ICT-industry, which covers more areas than the division of industry to be discussed. This should not be a problem, because the global characteristics of these figures will be the same for the discussed industry.

Another factor is the infrastructure of a country. If the physical infrastructure of a country is good, then this has a big influence on the supply of material and parts for products and the distribution of the end-products of an industry. Besides the physical infrastructure factors like the internet penetration of a country should be taken into consideration. Nowadays this is an important medium for the gathering and the distribution of knowledge and besides that, it is also largely used for communication purposes.

Japan

The penetration rate of internet in Japan in 2002 was moderately high, but not top notch. Of the total population, 44% had access to the internet, a sixteenth place worldwide. For comparison, in 2002, Sweden was best with 64.7% and the US fourth with 59.8%. The physical infrastructure is very well developed in Japan with freight transport that is very road and sea oriented.

In table 6.4 the productivity and wages are displayed. The relative numbers shown are in comparison with the United States.

	Japan (US = 100)	The Netherlands (US = 100)
Productivity:		
Added value	80	47
Gross production	119	75
Wages:		
Level of wages	68	66
Wage quota (wages/add value)	85	140

Table 6.4: Productivity and wages of division 32 for Japan compared to the Netherlands.

The gross production is relative high in Japan. The added value is fair and the wages are low compared to the level of wages in the United States. This results in a good wage quota, meaning that the productivity is high with relatively low wages.

The Netherlands

The Netherlands possesses one of the most internet-ready environments in Europe. It has one of the highest internet connectivity rates in Europe and one of the top cable penetration rates globally. In 2002, 58.1% of the population had access to the internet, a worldwide sixth place, against a European average of 43%. This greatly stimulates the development of knowledge due to the extended availability of information. Furthermore the Dutch physical infrastructure is at a high level, for instance the harbour of Rotterdam, which is a main portal from and to the rest of Europe.

An overview of the wages and productivity is presented in table 6.4, relative to the United States. As can be seen is that especially the added value, but also the gross production are relatively low in the Netherlands. On the other hand, the wages are, relatively to the US, less high, so this compensates a bit for the meagre productivity. Overall the expenses for labour per unit produced in the Netherlands, are higher than average.

6.3.4 Firm strategy, structure and rivalry

This paragraph explains how firms are organized, and how they compete within their markets. Firm structure and strategy strongly influence the ability of a company to adapt their production to the demand of the consumer.

Japan

The semiconductor industry in Japan started as follows. In the 1960s some Japanese firms explored the concept of micro modules and solid circuits that eventually led to integrated circuits. However, they where lagging considerably behind the market leaders, US firms, and this blocked advance of innovation of Japanese firms in IC’s. Their strategy was to attempt to replicate existing technology of US engineers. Reproducing the products showed not to be an easy method of making money, as one might think. It involved much trial and error, because the Japanese engineers lacked experience with the technology. In this path of catching up with the US Japanese engineers realized that they needed successful and unsuccessful projects to get a better grasp of the technology, and to come up with ingenious solution for faced problems. This ‘reverse engineering’ together with huge investments in R&D closed the gap, and soon after, they overtook the US.

Another advantage within this industry was that the Japanese firms were already horizontally diversified and vertically integrated before the semiconductor era. This was not the case with most of their competitors in the US. Vertical integration means that more stages in the production of an end product are done in-house. When a firm is more vertically integrated it is less dependent on suppliers or distributors and thus has more power. Horizontal diversity is the amount of difference between the various end products of a firm. With more diverse end products a firm is less dependent on each separate market. This horizontal diversity made it possible that the Japanese firms began using a certain semiconductor component, which was originally made for a specific end product, in various other end products. This gave a great impulse to other related divisions, like consumer electronics. A disadvantage of Japanese firms is that its structure is generally group oriented. Decisions are made on consensus, which is rather slow and thus inhibits innovation.

When looking at the structure of the markets, Japanese firms together had a share of 22% of the global semiconductor market in 2000. Recently, Sony Group and Matsushita together accounted for 35% of the global market for audio and video consumer electronics. On the European market of audio and video consumer electronics, Sony Group and Matsushita had 31% of its total. These huge market shares create resources for further development of the concerning companies. Also, the amount of serious competitors within a certain electronics sub division in Japan is significant, which ensures fiercer competition.

The Netherlands

The Dutch electronics industry is mainly dominated by multinationals like Philips, ASM Lithography and Océ. The fact that the market is dominated by these multinationals gives occurrence to rather strange facts and figures. These companies invest a certain amount of resources in research and development, but these investments give a relatively higher rise of productivity abroad than in their home country. This is due to the fact that generally, the actual production is abroad and the management side of the company is in the Netherlands. The conclusion of the CPB (Dutch Bureau for Economic Analysis) is that in the way statistics currently are produced, an industry division of a country which is dominated by multinationals cannot be described correctly.

The main competitor of Philips in the consumer electronics industry is Sony Group. Worldwide, on the market of audio and video consumer electronics, Sony Group is the leader with 22% the total sales. With 13%, Matsushita Group comes second and Philips, with 10%, comes third. Looking at Europe, Sony Group is still number one, with 21%, but is closely followed by Philips on the second place, with 17% of the total sales. The goal in this division for Philips for the future is to get second outside Japan. Finally, the mutual competition of Dutch multinationals in this division is neglectable compared to competition with foreign companies. Also, as each of the Dutch companies mainly operates in a different sub division, the domestic competition is not that fierce compared to other bigger countries.

6.3.5 Related and supporting industries

For a continuous development of a certain industry, the supporting industry must also undergo a strong development. More advanced end-products demand materials that satisfy higher standards. Secondly, the concentration of related competing firms within a certain area, also called clustering, creates an environment that pushes and pulls the firms to a higher level of technology. Pull factors are the stimulants to keep up with or overtake rivals within an industry. An example of a push-factor is employees who switch to work for another related company. This transfers the acquired knowledge of one firm to the other and stimulates further innovation to regain competitive advantage, which is a pull factor.

Japan

Due to the growth of the end products industry in Japan and the vertical linkage between the industries, the supporting industries also greatly grew. For instance, Nikon was, and still is, a strong optical equipment manufacturer, but is also one of the world's leading manufacturers of steppers for the semiconductor industry. However, knowledge transfer between related companies in Japan is rather small. In most cases, employees work their whole career for one company, and thus keep their gathered knowledge within this company.

The Netherlands

Vertical linkages of Dutch companies with supporting industries in the electronics industry are mainly international due to the dominance of multinationals in this division in the Netherlands. Furthermore, clustering is not extensively carried out in the Netherlands, according to Michael E. Porter [117]. This lack of clustering can be seen in the relative number of patents that are registered every year, because this is lagging behind European level and other major players in this market. The CPB states however, that this in essence is true, but is not as bad as stated, because of the misrepresenting statistics mentioned in the section about firm strategy, structure and rivalry. They found out that Eindhoven, which is the home base of Philips, is one of the centres of technology of the electronics industry in Europe and that some clustering is present there. As for knowledge transfer, employees working for Dutch companies do switch between firms, which levels competitive advantage.

6.3.6 Government

The government is strongly influencing the competitive forces within an industry. They can stimulate the division in different ways. One of these is by directly of indirectly financially supporting the division. Governments are largely financing research at universities and research institutes which carry out research for governments but also for firms. Therefore R&D expenditures can be seen as a financial stimulation of the government on the electronics industry. Besides the financial support, the government also has a big influence by making policies and international agreements.

Japan

The Japanese government is actively stimulating the market access and industry cooperation. A good example of this is the international semiconductor agreement.

On the second of August, 1996, Japan and the US reached an agreement on semiconductors. This agreement was an industry-to-industry agreement with oversight by the government. Because of this agreement a forum to expand the international semiconductor industry cooperation was provided. This cooperation could be in areas such as standards, market opening initiatives, intellectual property rights and market development. Also a broad range of market data was provided for industries, including foreign market share, useful for the presentation to governments. Governments then can review these activities and reports and monitor the situation in Japan and other major markets. The agreement also created the need for a Global Governmental Forum to discuss the semiconductor industry at governmental level. The agreement also provided the possibility for other governments of major semiconductor producing countries and other economies to participate in the forum.

The 1996 agreement was replaced by the multilateral agreements on semiconductors made on June 10, 1999. These agreements succeed the World Semiconductor Council (WSC) and related governmental consultations. These new agreements also provide that other governments or authorities whose industry associations that joined the WSC may become parties. This can only be done if they support the objectives of the Joint Statement. This resulted in the joining of the newest member, Taiwan. The agreements will be reviewed after five years, on August 1, 2004. There is a chance it will be modified as a whole or by part at any time by mutual consent of the parties. The new Joint Statement will include a commitment by all parties to achieve barrier free trade in semiconductors in markets worldwide.

Another important factor is the R&D expenditure. Japan has a high R&D expenditure, which in the year 2001 was 3.09% of the gross internal product. The total amount of R&D budget originates for 20% from government money and 72% is from money spent by businesses.

Year	% of gross internal product	
	Japan	The Netherlands
1995	2,69	1,99
1996	2,77	2,01
1997	2,83	2,04
1998	2,94	1,94
1999	2,94	2,02
2000	2,98	1,90
2001	3,09	-

Table 6.5: R&D expenditure of Japan and the Netherlands.

The Netherlands

It is generally known that the Netherlands has a knowledge-based economy. The European Union and the Dutch government have a policy that within the next ten years Europe has to be leading knowledge-based economy of the world. That is why these governments are stimulating the expenditures on research and development. In the Netherlands the total R&D investments are more or less steady for the last years (table 6.5).

The financing of the total R&D in the period 1995-2000 consisted for 39% of government money and for 48% of businesses money. For the US this is 31% and 65% respectively and for Japan this is 20% and 72% respectively. One may conclude from these figures that the government of the Netherlands is spending a relatively large amount of money on R&D, or the businesses are spending a relatively small amount of money in R&D, compared to other countries. According to Michael

E. Porter [117], the conclusion is that Dutch businesses are spending too little of their funds in R&D. In the Netherlands, the electronics industry is the biggest spender of the R&D funds. Philips has the largest expenditure of all the firms in the whole country, in the year 2002 Philips has spent 1050 million Euro on R&D. There is no other company in the whole country that spends such a large amount of money on R&D.

6.3.7 Chance

The factor chance can also have a big influence on the division. When analyzing an industry division, this factor has to be taken into account. Examples of chance factors are wars, pure inventions, breakthroughs in basic technologies, external political developments and major shifts in foreign market demand. Chance can create discontinuities that unfreeze or reshape industry structure and provide opportunities to gain advantages over others.

Japan

An example of a negative influence on the electronics division in Japan in recent history is the Sars virus in 2003. No cases of this virus where found in Japan, but it slowed down the Asian area which hurt the Japanese firms with overseas operations. The Japanese electronics giant Matsushita Electrical Industrial, which produces Panasonic products, had to close two factories in China for some time after several workers were found to have Sars.

The Netherlands

An example of the factor chance on sales figures are big sport tournaments, like the European soccer championship. These events could give the sales of television sets in Europe a temporary boost.

6.3.8 Hot innovations

The paragraph about demand conditions stated that currently LCD screens are hot selling items. Everybody wants the biggest and thinnest television on the wall or a computer display that takes as little space as possible on their desk. Also laptops have to be as thin and light as possible. Therefore the focus in this section is on display innovations and some examples of advanced display technology are presented from Japanese companies as well as a Dutch company.

Japan

The Sharp Corporation claims they are now developing a paper-thin liquid crystal display. This display can be bent as if it is a piece of paper. Normal liquid crystal displays need a backlight system and therefore it is difficult to reduce the thickness of such a device. Sharp is claiming it is creating a display that does not require such a backlight system. The new technology should be on the market by the end of 2007.

Another innovation topic is a LCD monitor which enables 3D stereoscopic display. This is again an invention of the Sharp Corporation. This monitor can display 2D as well as 3D images. This LCD monitor projects an image for the left as well as the right eye at the same time instant, which provides the 3D image. The only problem is that, to be able to view the tree dimensional image, you have to be straight in front of the display. A 15 inch version of the LCD monitor is already on the market. It can be used in a wide range of applications in areas such as education or gaming.

The Netherlands

The hottest innovation we found from a Dutch company, Philips, is a new sort of wall mounted, very flat digital TV: the Philips MiraVision Mirror TV. When the screen is switched on, anyone standing in front of it sees only the picture. With the television switched off, the surface looks like an ordinary mirror. The MiraVision can even fulfill both things at once. Anyone wanting to watch TV while brushing their hair or fixing their make-up can switch to 'picture in mirror' mode, which displays a small image in the corner of the frame. The screen can also be wired to a PC and used as a monitor. Furthermore Philips hopes to produce a waterproof version for the use in bathrooms. Philips MiraVision Mirror TV offers high quality video pictures through a special mirror material, which allows near total transmission of the polarized light output of the LCD screen. The MiraVision Mirror TV comes supplied with standard frame fitted. It can be mounted on a wall, to be used and viewed like a regular mirror. The MiraVision Mirror TV offers new application opportunities in the hospitality environment in guest rooms, lobbies and bars.

6.3.9 Comparison and conclusion

In the previous paragraphs Japan and the Netherlands were examined using Porter's diamond in the division "manufacture of radio, television and communication equipment and apparatus". In table 6.6, a comparison is shown for the different aspects of Porter's Diamond.

	Japan	**The Netherlands**
Demand	High, early acceptance of new technology	Moderately high, acceptance of new technology with some delay
Factor Conditions	Good: high productivity, very good infrastructure	Mediocre: moderate productivity, very good infrastructure
Firm Strategy, Structure and Rivalry	Moderately fierce national competion, fierce inernational competition	Mediocre national competion, fierce international competion
Related and Supporting Industries	Tightly linked	Modestly linked
Government	Fairly high R&D expenditure and a stimulating attitude	Fairly high R&D expenditure and a stimulating attitude

Table 6.6: Comparison table on division 32.

When looking at the comparison table 6.6, it is clear that the concerned industry in Japan has better conditions to be innovative and competitive. These favorable conditions are a consequence of a combination of all the relevant factors mentioned in table 6.6. The divisions which have the most promising growth numbers are: LCD screens, digital (video) cameras and DVD. Furthermore the market for semiconductors still keeps up a steady growth, mainly due to the wide applicability of these products.

Advanced displays are hot innovation topics in this division. In this area, Japanese companies as well as a Dutch company are developing new technologies, each of them bringing displays to a higher level in their own way.

6.4 Division 33

by Maarten Bezemer, Casper van Benthem and Frank van der Aa

6.4.1 Introduction

Division 33 is discussed in this section. The reason for choosing this division is that some of the companies, universities and institutes that will be visited in Japan belong to this division.

The description of division 33 is: "Manufacture of medical, precision and optical instruments, watches and clocks" [99]. The focus will be on the following classes:

3311 Manufacture of medical and surgical equipment and orthopaedic appliances;

3312 Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment;

3313 Manufacture of industrial process control equipment.

Even though this division is obviously of enormous importance to any modern society, it is difficult to find interpretable data on this division. The data is often not presented for this division itself, but it is usually merged with other divisions into 'ICT-industry'. Over the world, various division definitions exist and not only the used reference number, but also the grouping of specific industries may vary widely. Mainly because of this difficulty, some other useful division definitions are given below. After that, the factors that define this division are dissected. For each subject, first Japan will be analyzed, followed by a short analysis of the Netherlands and of course this is again done with Porter's Diamond. The two countries will be compared and finally some conclusions will be drawn, whilst attempting to answer the research question.

Division definitions

The division 33 that had to be analyzed, is an activity classification and is defined by the United Nations (ISIC Rev.3.1). There are many more definitions. Most of the statistics bureaus in each country have their own definitions. Here some relevant and frequently used definitions are being given, with the numbers which are mostly equal to ISIC.

One international definition is SITC Rev.3 and is an abbreviation of Standard International Trade Classification. It is a product classification and the division relevant for this chapter 87: "Professional, scientific and controlling instruments and apparatus".
This division is divided into the following groups:

871 Optical instruments and apparatus;

872 Instruments and appliances for medical, surgical, dental or veterinary purposes;

873 Meters (for usage) and counters;

874 Measuring, checking, analyzing and controlling instruments and apparatus.

The definition used by CBS is SBI '93 and is an abbreviation of "Standaard Bedrijfsindeling 1993". They have defined it for all statistics in the Netherlands. This has happened in close cooperation with international organizations like the UN and the EU, so there are similarities with other definitions. The according division is 33: "Medical and optical apparatus industry".

Furthermore, CBS has another classification. In fact, this is a product group which is called NR. The abbreviation stands for National Accounts. Some numbers, which belong to this division, are:

3320100 Measuring and controlling apparatus;

3320800 Parts of measuring and controlling apparatus.

For specific products, again a completely different code is used, e.g. microscopes belongs to division 3320100 and has code 901202. This code is used in publications and monthly statistics of CBS.

The Standard Industrial Classification for Japan is JSIC Rev.10 (1993). The relevant numbers are 3069, 3071, 3211 through 3219, 3221, 3241, 2998, 3072. Other codes are also used in Japan. For products HS Rev.1 code, in which the divisions starting with 90 are most relevant to us.

Other definitions in other countries include:

- NAICS (North American Industry Classification System) is used in Canada and the US: e.g. 334515 "Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals", 334516 "Analytical Laboratory Instrument Manufacturing";
- US SIC (United States Standard Industrial Classification): e.g. 3823, 3826;
- ANZSIC (Australian and New Zealand Standard Industrial Classification): e.g. 2839.

NACE (Standard Classification of Industries) matches ISIC at the required level of detail and provides an even finer breakdown.

6.4.2 Demand

When analyzing the properties of any division, the most important aspect is, naturally, demand. Without demand, an industry simply cannot exist. This section will give an analysis on demand in the explored division.

Precision, measuring and control equipment is usually not for national purposes and is very dependant on the willingness of companies to invest in new equipment. Still, much of this equipment is needed in almost all industries. If a manufacturer wants to keep producing with an ever increasing capacity, faster and more precise machines are needed, for which measuring and control are indispensable.

Naturally there will always be demand for medical equipment, or at least, there will be in the world as we know it. In our society diseases and disabilities need to be treated with any means available. The companies that produce in this division have one thing in common: all are world-class manufacturers, supplying to the world's most demanding customers, including medical establishments that set some of the most stringent standards for the simple reason that human lives are involved.

Japan

Considering the kinds of equipment that are needed, Japan is fairly representative for the international market. Japan's import is about twice the export [118], so there is enough demand for businesses to be successful.

The medical equipment market in Japan is currently worth 23.4 billion US Dollar, of which approximately 40% is imported [119]. The market is second in the world behind the US market, with expected US import growth of 5-10% over the next few years. Furthermore there is a high import demand for such products as specialty catheters, pacemakers, artificial joints, laser surgical equipment, cardiac valve prosthesis, etc. [120].

Home health care products currently account for approximately half of Japan's health industries market. Cost containment pressures are also causing Japanese buyers to pay increasing attention to the economies and lifesaving benefits of certain technologies [121]. Prices can be expected to fall because the government is attempting to improve the market for medical devices.

The Japanese population is aging very fast. In twenty years, for every two people in their working years, there will also be a person over 65 [122]. This means that much more money has to be spent on health care in the future, which is very interesting for the medical equipment market [123]. Because of the increasing need for people being treated at home, many innovative products are needed to handle the increased requirements for health care. The market for the elderly and the assistive devices/rehabilitation equipment market are being underserved by domestic Japanese production. The demand for medical devices in Japan, which is projected to grow at a yearly rate of about 6% over the next three to five years, will also be driven by such innovative products as high-power laser equipment and ultrasonic surgical equipment [124].

The expectations for this market are positive and the market will improve. The import in the total turnover is still increasing. Much of the renewal in the medical market comes from the foreign countries. European manufacturers have a good reputation and are seen as innovative. All together, the medical division in Japan is very interesting for Dutch manufacturers [125].

Year	Market	Home production	Import	Import from total market (%)
1991	8606	6675	1931	22.4
1996	14497	9975	4522	31.2
1999	14455	9424	5031	34.8
2000	15300	9751	5549	36.3
2001	15904	10050	5854	36.4

Table 6.7: Japanese market for medical apparatus (in million US Dollar).

The import has increased from 22.4% in 1991 to 36.4% in 2001, which factors up to 5.8 billion US Dollar (table 6.7). The reasons for this are greater openness to the foreign countries, the absence of a home alternative and a lot of new nursing homes. Important import products are pacemakers (220 million US Dollar in 2001, 23.9% higher than in 2000) and MRI apparatus (200 million dollar, 34% higher than in 2000).

Japanese manufacturers are searching for manufacturers in foreign countries with more experience. There is an increasing demand for technologically innovative products to decrease costs, because the population of Japan is ageing very fast. In 2001, the US was the most important importer for medical apparatus, accounting for 50% of the Japanese export. The EU was the second importer accounting for 28.6%, which is a total import of 1.6 billion US Dollar. Inside the EU, Ireland is the most important importer for 10.7%, followed by Germany with 7.1%.

The major users of the other equipment in division 33 are research institutions and government-affiliated measurement organizations, university laboratories, and manufacturers and other business entities that own factories.

In Japan, the following business practices frequently apply. In the case of large equipment purchases, environmental measurement and analysis equipment is sold as a package together with the computer used for data processing. Here, related products such as optional software are sometimes offered free. Discount sales are common, with products going for less than the listed price. When manufacturers sell their goods through an agent, the former occasionally pays the latter a rebate according to the sales volume.

The Netherlands

In the Netherlands, many of the conditions for demand are about the same as in Japan. First of all, the Netherlands also have to cope with an aging population.

The Netherlands is in the market for MRI apparatus the third exporter behind the US and Germany. For the future some interesting parts of this market for exporters are high technology products as pacemakers, analyzing apparatus, art flaps, and basic technology for medical apparatus, surgical instruments, cerebral radiotherapy, laser equipment and navigation systems for brains [124].

Figure 6.20 shows the import value in the Netherlands for SITC 87 from January 2001 until February 2004 [126].

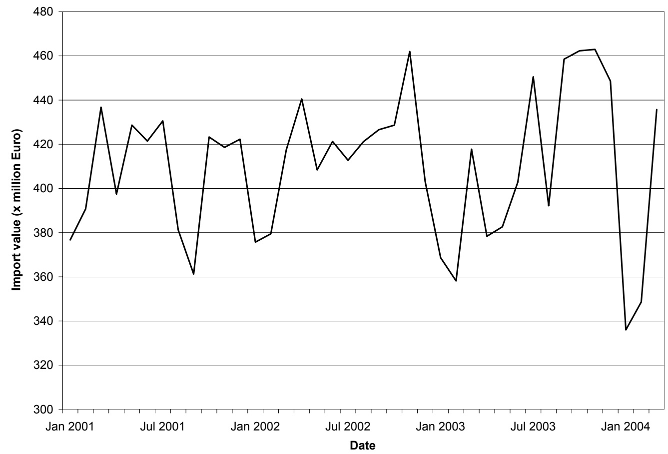


Figure 6.20: Import value in the Netherlands for SITC 87.

6.4.3 Factor conditions

In this section the important factor conditions, such as infrastructure and productivity, will be discussed for Japan as well as the Netherlands.

Japan

In the last half of the previous century, Japan has emerged as a country with significantly developed high-tech industries.

An important limitation to production in Japan, are its limited natural resources. This is, however, mostly applicable to mass production. The country is also far away from their major export markets for high-tech products, being the US and Germany. There is, however, a well developed infrastructure and furthermore there are many research institutes to maintain leadership in several important markets.

Companies are having trouble to find adequately qualified workers [127], which makes it troublesome for companies to grow. There is some unemployment however, which is most of all under unqualified workers. When it comes to setting up or operating a business, Japan is the most expensive country in the world, according to a recent study by the Economist Intelligence Unit [128]. Labour costs in Japan are very high.

The Japanese market for investment banking and venture capital has declined by 8.9% since 2001 to a value of 246,385 billion Yen (1,964.8 billion US Dollar) in 2002. The market grew by 27.6% over the observation period. The investment banking market in Japan is very limited with significant participation by the foreign investment banks in both advice to mergers and acquisitions and securities underwriting [129].

The Netherlands

One thing that makes the Netherlands very attractive is that the country is a very important center of trade and that transport over water can be utilized to a great extent. It is located fairly well, in a very densely populated region. However, labour is quite expensive.

The Netherlands ranks among the top five in Europe in the market for venture capital investments. Venture capital availability in Europe is estimated to be at least 75 billion US Dollar. In 1997 approximately 50 Dutch venture capitalists invested 850 million US Dollar, over 30% more than the previous year. The most popular divisions were biotechnology and computing [130].

6.4.4 Firm Strategy, Structure and Rivalry

This paragraph is about firm strategy, structure and rivalry in Japan as well as in the Netherlands and describes factors like the amount of production, the level of prices for medical equipment and the difficulties faced when entering the market for medical equipment.

Japan

Japanese high-tech industries followed a path of steady gains in world market share throughout the 1980s. In 1989, Japan accounted for 28% of the world's production of high-tech products, moving up 4 percentage points since 1980. Japan continued to gain on the United States until 1991, when, for the first time, it caught up with the United States to become the world's leading high-tech producer. Since then however, Japan's market share has dropped steadily. In 1995, after accounting for more than 30% four years earlier, it had fallen to under 23% of the world production [131].

Table 6.8 shows the Japanese production of the analyzed division [132].

Year	ISIC			
	3310	3311	3312	3313
1994	3418	1070	2078	270
1995	3710	1136	2293	281
1996	3895	1244	2353	298
1997	4180	1248	2637	294
1998	4266	1423	2566	277
1999	4066	1466	2309	291
2000	4263	1423	2501	340

Table 6.8: Production of division 33 for Japan in billion Yen.

Medical equipment in Japan is very expensive. Pacemakers, for example, can be

7 times more expensive in Japan than in other countries [124]. One of the main reasons for this is that in Japan, there are many different layers of distribution. In the early nineties, there were 2.2 times as much layers of distribution in Japan than in the US. Furthermore a high number of retailers per capita, the conspiring of manufacturers and the increasing distributor prices. Japan's Fair Trade Commission is trying to enforce deregulation in order to improve pricing and quality of distribution.

Table 6.9 shows the production of measuring equipment and instruments [133].

Year	Production value (Billion Yen)
1990	513
1995	425
1999	410
2000	416
2001	404

Table 6.9: Production of measuring equipment and instruments for Japan in billion Yen.

When a foreign manufacturer joins the Japanese market, it usually ships its products to Japan through trading firms for trial purposes. If the market proves to be successful, the manufacturer usually establishes a subsidiary in Japan.

In a field where products are immature and technical innovations are widespread, a single major technical innovation that has much effect can mean a surge in market share. Therefore, in such a field, it is still possible for a business to enter the research and development race [134]. The question for foreign medical device companies is not whether, but how to penetrate and and optimize their efforts in the Japanese market [124].

The Netherlands

For the Netherlands, little relevant data on the determinant of firm strategy, structure and rivalry has been found. Collecting data from reliable sources has proven to be quite difficult for this sector. To give the reader an idea on how the market in the Netherlands is structured, an analysis that is based on generic ICT industry data is given.

In the Netherlands, the share of total OECD (Organisation for Economic Cooperation and Development) merchandize exports for ISIC 3312 and 3313 has decreased from 14% to 11% in the period 1990-2000. In 2001, Ireland reported the highest share of ICT sector exports in the total merchandize exports (40%). In contrast, Iceland was the country with the smallest share of ICTs in the total merchandize exports (0.2%). Japan and the Netherlands are between them with 25% and 23% respectively. Generally, OECD countries with large ICT sector exports at the end of the decade also had large exports at the beginning of that decade. However the Netherlands rapidly increased their ICT sector exports during the 1990s. Japan was one of the two countries where the share of ICT sector exports was lower in 2001 than in 1990. In 1990, Japan had about 26% against 9% for the Netherlands. In 2000, about 8% of these ICT sector exports in

Japan came from subdivisions 3312 and 3313. For the Netherlands this is smaller than 6%. This seems not a fundamental difference between the countries for this sector, because the other countries are between 1% and 40% [135].

Even though the sector for audio, video and telecommunication equipment has been the sector with the highest productivity for the period 1996-2000, it is closely followed by the sector of medical, measure and control equipment. Volume development of the added value is larger than that of the ICT-industry completely and also that of the rest of businesses. Recently, the low turnover expansion in Dutch ICT-industry seems at lower aggregation level mainly to the moderate performances of two components: office machines/computers and medical, measure and control equipment [136].

Europe hosts many EDCs (European Distribution Centres) set up by US and Asian companies. 56% of these are located in the Netherlands. Of the 344 American EDCs located in the Netherlands, more than 40 of them trade in medical devices and instruments. Their number is exceeded only by US-based sellers of office equipment and personal computers [137].

In 2001, 12% of the total ICT industry export is from division 33, but almost the complete sale of the ICT industry is in the Netherlands itself. In 2001, the home production for division 33 was 1524 million Euro (CBS) and the use of apparatus from this division was 2487 million Euro. From this use is about a half for investments and a considerable part of the rest for consumption [136].

6.4.5 Related and Supporting Industries

Of course the manufacturers of medical equipment rely on many other industries, just like other high-tech industries. Many materials manufacturers, but most of all technology-driven industries, like the electronics industry, are needed. Medical technology companies can draw strong support from electronics and precision engineering industry. This includes companies that build components and sub-assemblies, but naturally also those who manufacture the final products. Reverse logistics services provided by logistics companies, including the repair and refurbishment of medical equipment and sterilization services for those medical technology companies, are also very important. A short list of useful industries is: [138]

- Precision engineering of materials such as plastic, rubber, silicon and metal mould design & tooling;
- Designing & building industrial automation equipment & systems and providing automation solutions;
- Electronic components such as integrated circuits, connectors, optics, PCBAs, cables & wirings, power supplies, displays, resistors, capacitors, PC hardware, etc;
- Software development.

The mass-manufactured items are often made in China, or in other Asian countries.

Japan

Japan is well known for its electronics industry, which had greatly advanced in the seventies and eighties. Even though the market share in this sector has decreased, the knowledge and technology has always been present. Japan harbours plenty of precision manufacturers and high-tech tools for the production of precision equipment. For everything that can not be manufactured domestically, Japan has excellent trade relationships with the US and surrounding Asian countries.

Because many of the related industries are also needed for e.g. the automotive and computer manufacturers, they will continue to do business.

The Netherlands

Of course, the Netherlands requires the same supporting industries as described for Japan. The Netherlands is in a region without any cheap labour, so many materials must be produced far away, often in Asia. Luckily the Netherlands is known to be a country of tradesmen and for example the harbour of Rotterdam contributes greatly to the availability of various materials.

The Netherlands, has a good number of well-educated people, and the knowledge required for producing in the related industries is present. There are still craftsmen for making unique components and plenty of software developers.

6.4.6 Government

In the field of medical equipment manufacturing and sales, the government plays an important role. A government might want to invest in knowledge on this subject, either to make a contribution to health care, or to stimulate local export to improve the economy.

Japan

In the nineties Japan has suffered a recession. Nevertheless, the Japanese economy is one of the strongest in the world [139]. Government efforts to revive economic growth have met with little success and were further hampered in 2000-2003 by the slowing of the US, European, and Asian economies. Japan's huge government debt, which is approaching 150% of the GDP, and the ageing of the population are two major long-run problems [140].

Even though it is said to be easier to enter the medical equipment market in Japan than, for example, the United States [119], there are still many regulatory issues that must be addressed before a company is able to sell any type of medical equipment in Japan. Getting approval for using medical equipment in Japan is a long and complicated process.

The Japanese government implemented a new, long-term national insurance system in April 2000 that provides for nursing costs, home care, and encourages private companies to enter the health care system as providers. As the government encourages patient treatment at home, the new insurance program opens opportunities for medical device companies to develop and market high quality home care equipment. While distribution and reimbursement of home care equipment must go through the hospitals, still elder care represents a large potential customer market for medical device companies with products like dialysis equipment for kidney patients, oxygen generators for lung patients, hearing aids, pacemakers, and home health care services [120].

The Japanese government wants to promote the foreign direct investing to revitalize the economy. In five years after 2003, the level of investments has to be doubled. One of the most important divisions is the health care. It builds so-called ‘Special Zones for Structural Reform’ to make investing easier. Also some regions have special incentives. One of them is “Kobe Medical Industry Development Project”. Since the last years it is easier to enter the Japanese market, because they are searching for manufacturers with capital, new technologies and business models.

The government changed the Pharmaceutical Law in 1995. As a consequence the requirement for approval of specific products with a very small risk for people was erased. This means much easier import requirements. In July 2002, there was a second change. This was for an easier access to the market for manufacturers with no own production facility. The law should also make an easier start for new manufacturers. However, there are new standards that guarantees for quality and post marketing safety. In December 2002, the government announced a “Three-Year Programme for Promoting Regulatory Reform” (revised), which should make it easier to introduce changes in the control of the medical division.

For manufacturers in the medical division, who want to enter the Japanese market, there are two subsidized programmes. The first is called “JAPTA” and is an individual programme for exclusively Dutch manufacturers. Within the framework of this programme, it is possible to get a market scan for your product subsidized. On account of that you can visit Japan or not. The embassy makes a tailored program for possible partners. The second program is the “EU Gateway to Japan” and is a collective European program.

The Netherlands

Various regulations considering trade and manufacturing are made by the European Union, instead of the Dutch government. The regulations for medical equipment are of course very strict. Much other equipment has to comply with many regulations to be given the required “CE” mark. International trade is generally supported and several projects exist to improve trade relations with various countries.

6.4.7 Chance

There are much global effects, which may have a big influence on the innovation in our division. These effects may influence the investments, the employees and the import and export possibilities of the companies or research institutes.

A very important effect on the industry is war. War may influence our division as well, since parts of it are boosted by a war. If many people get wounded, the medical equipment division would get a significant boost, especially in the field of artificial limbs. For the sensor and control equipment war would undoubtedly be very beneficial, since many military installations depend heavily on this kind of equipment. The current situation in Asia is quite stable. Although there still are some tensions in the region, but those have been there for a long period.

The climate may have some influences on the division as well. Just to give an example, high temperatures result in more (elderly) patients in the hospitals, which results in the need of more medical equipments. However these medical equipment is not new, so no development or innovation is needed to produce it.

Another factor which may influence the division is politics. The government gives research-institutes big subsidies for new developments and technologies. So when the government changes after elections, it may be possible that the subsidies change and so the rate of the innovation-speed will change. The political situation also influences how willingly new companies establish in this particular country instead of another country. Both the Netherlands and Japan stimulate companies to establish down in their country by giving subsidy, tax-benefits or required technical support to those companies. A lot of other countries are doing similar things so there is a lot of competition between them.

Still, many influences such as politics and the stock market are applicable to many high-tech industries and have been covered by the macro-level researches.

6.4.8 Hot Innovations

To get an idea what kind of research is done in Japan this paragraph describes some hot-innovations for each analyzed class.

An example of class 3311 is about a newly developed chip to measure the blood sugar level by the Research Centre of Advanced Bionics (RCAB) [141] of the National Institute of Advanced Industrial Science and Technology (AIST). The chip requires the least amount of blood sample in the world (200 nL), allowing a patient to have measurement with less pain and in shorter time compared to existing devices. In this way, the patient's burden will be reduced. Another advantage is that the chip is cheap so it is possible to increase the frequency of the checks to get a more accurate image of the blood sugar level. Furthermore it is possible to detect diabetes and other illnesses in an earlier stage than before. Because of the earlier detection, the medical care costs to treat the illness will decrease.

A second example is about research from the Photonics Research Institute (PRI) of the National Institute of Advanced Industrial Science and Technology (AIST) [142]. This group has developed the world's first bio-sensor. The sensor converts light (photons) into an electrical signal by combining bio-conjugated materials with semiconductor devices. Old fashioned sensors dissipate much heat and it is therefore difficult to further reduce the size and increase the resolution. The new sensor, made of bio-materials, dissipates less heat and therefore can be made smaller to increase the resolution. After the photons are converted to a bio-electrical signal there's a 'molecular converter' to convert the signal into a usable electrical signal.

The University of Twente has developed a virtual reality operating theater [143]. Using the virtual reality it is possible to train complex medical treatments without the need of a real patient. Due the combination of sight and touch the operation will be simulated like in real life. Furthermore the doctor in training will not only see it happen on the screen, but for example also feels the interaction between needle and skin.

The laboratory for Electronic Instrumentation searches for ways to combine integrated smart signal processing circuits together with integrated sensors in order to obtain integrated smart sensors, which enable economically feasible sensor microsystems [144]. Three main topics in this field have been defined:

1. A large project on electrical sensor interfacing meets its challenge in a combination of high accuracy, low power and re-usable IP functions, such as: low-power operational and instrumentation amplifiers, low-power analogue-to-digital converters, bus interfaces, and calibration and self-test techniques.
2. The compatibility of sensors and circuits is often hampered either by the sensor, for instance if special process steps are needed that interfere with the circuit requirements, or by the circuit, for instance if the circuit heats up the sensor too much. Therefore, a special project is dedicated to the compatibility challenge.
3. As the sensor is often in the control loop of a system, the reliability of the whole system depends on the sensor. Hence, reliability aspects have to be taken into consideration. If one wants to design and produce low-cost and durable sensor systems also the packaging is an important design challenge.

Most common manipulation tasks in automated manufacturing do not require the flexibility offered by multi-fingered robot hands. Motivated by this observation, Canny and Goldberg [145] advocated the use of manipulation systems that are based on simple hardware elements performing simple physical actions. Such systems offer several advantages over traditional robot hands. Recent results confirm that sequences of simple actions, like pushing, squeezing, and dropping, by cheap manipulators using simple sensory input can accomplish the same tasks as complex robot hands accompanied by sophisticated sensors. These results, however, apply mostly to perfectly shaped planar polygonal parts. The research in their proposal takes up the challenge to tackle this severe idealization, as real industrial parts are three-dimensional, often curved, and manufactured to tolerances. One main objective is to analyze the relation between physical actions and their impact on curved or three-dimensional parts and to use this knowledge to derive efficient and complete algorithms for planning sequences of simple actions that will accomplish a higher-level manipulation task. The other main objective is to study the relation between manipulation plans and their desired insensitivity to small variations in part shape and disturbances in manipulator control. As part geometry and motion are crucial to the definition, modelling, and solution of the problems, techniques and insights will be employed from the confluence of computational geometry and motion planning. These techniques, supplemented by physical part properties, offer a prospect of planning algorithms that facilitate the automated design of reliable low-cost solutions in automated manufacturing.

6.4.9 Comparison and conclusion

Table 6.10 shows a comparison between Japan and the Netherlands on the different aspects of Porter's Diamond as a result of the analysis on division 33.

	Japan	The Netherlands
Demand	Increasing demand, relies heavily on import	Increasing demand, high export
Factor Conditions	Very expensive	Many new investments, low productivity
Stategy, Structure and Rivalry	Improving, getting easier to enter	Most of all provide distribution
Supporting Industries	Widely available in the rest of Asia	Good availability of materials
Government	Trying everything to improve economy, healthcare quality	Much support for trade

Table 6.10: Comparison table on division 33.

It is obvious that this division includes many important technologies. This is an essential part of our high-tech society and there is a constant demand for much of the equipment produced here. Not only there are many highly innovative topics researched for producing better equipment, or very neat equipment which has never been made before, but also the measurement/control division is responsible for enabling their users to continue with other innovative processes. Being innovative is an absolute must to stay in the business, but with a revolutionary idea, any small company could conquer the market.

There are quite a few things that can make it very hard to succeed in Japan or the Netherlands. Fighting your way through regulations takes an incredible amount of work if you want to export something to one of these countries. In the past however, it used to be much worse in Japan. While the primary goal of the governments usually is 'to improve the economy', this sometimes goes along with deregulation and spending more on research. This is very important for this division to keep growing, and innovating.

6.5 Division 73

by Casper Smit and Bertjan Davelaar

6.5.1 Introduction

This part of the meso level research is about division 73, which is the division of "Research and development (R&D)". It will cover class 7310, which is about "Research and experimental development on Natural Sciences and Engineering (NSE)".

The research and experimental development on NSE of Japan will be compared to the Netherlands and if no information is available the EU or the US will be used. The investigation is again done according to Porter's Diamond. This division includes three types of research and development [99]:

- Basic research: experimental or theoretical work, undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without particular application or use in view;
- Applied research: original investigation undertaken in order to acquire new knowledge, directed primarily towards a specific practical aim or objective;
- Experimental development: systematic work, drawing on existing knowledge gained from research and/or practical experience, directed to producing new materials, products and devices, to installing new processes, systems and services, and to improving substantially those already produced or installed.

The R&D on NSE consists of [99]:

- Systematic studies and creative work in the three types of research and development defined above, in natural sciences (mathematics, physics, astronomy, chemistry, life sciences, medical sciences, earth sciences, agriculture, engineering and technology etc.). They are intended to increase the stock of knowledge and to devise new applications;
- Multidisciplinary research and development.

This division excludes [99]:

- Governmental administration of R&D and of associated funds in the various natural or social sciences;
- Administration and support of defence-related applied research and experimental development;
- Education combined with R&D;
- Raising and management of R&D funds for medical or other socially related R&D by charities.

The goal of the investigation is to learn about the complete division, but the available information is very closely related to other divisions like economy, politics and universities. The main goal is to give an overview about activities of research institutes and their environment. What projects are hot topics at the moment, what is the role of the government in this and what other institutes play a role?

The structure of this division is a little different compared to the other divisions. The other divisions all contain a paragraph describing the hot innovations. This division is about R&D and, in general, R&D supports the innovations rather than bringing the innovations on the market. However, still some innovations will be mentioned in the text.

6.5.2 Demand

Research and development is closely related to the factor demand. The main principals for R&D as well as some R&D expenditure data will be given below.

Japan

About 95% of the R&D assignments originate inside Japan. About 5% of the R&D assignments are from abroad. Major principals are government bodies, like the Ministry of Posts and Telecommunications, the Ministry of International Trade and Industry and different governmental agencies. Other principals are the Science and Technology Agency, the National Institute for Materials Science and other professional organizations.

The Netherlands

From figure 6.21, it becomes clear that the government has a less share in the funding of research over the last decade. Business enterprizes and abroad founders are getting a larger share. Table 6.11 shows us that compared to the old 15 members of the EU, Japan has a lead in R&D expenditures while the Netherlands is walking behind. However, this is the overview. In detail one can see that within the knowledge institutes, there are no big differences between the Netherlands and Japan.

	Total		Business		Knowledge institutes		Universities	
	Intensity	Trend	Intensity	Trend	Intensity	Trend	Intensity	Trend
Japan	++	-	+	-	+	o	o	-
The Netherlands	o	-	-	-	+	-	+	-

++ Highly above EU-15 average
o Equal to EU-15 Average
-- Highly below EU-15 average

Table 6.11: R&D funding in the Netherlands.

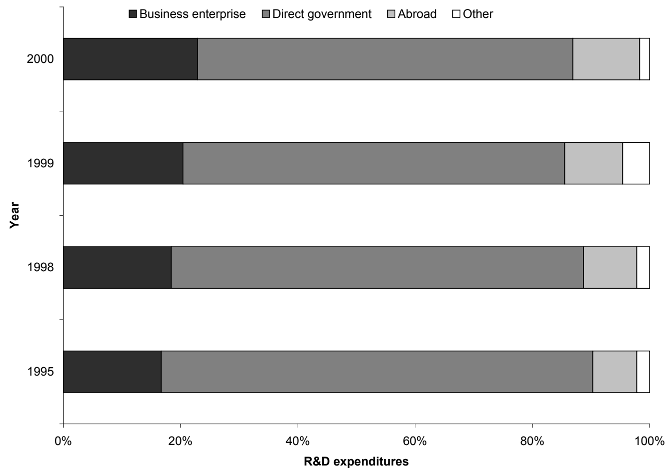


Figure 6.21: R&D expenditures in the Netherlands.

6.5.3 Factor conditions

To improve the quality of the R&D, good factor conditions are of great importance. Some of the important factors will be discussed below, such as infrastructure and patent systems.

Japan

The government constantly tries to improve the facilities, environment and infrastructure required for Research and Development at a high level. MEXT, a ministry that will be discussed in the paragraph about related and supporting industries, promotes the establishment and common use of SPring-8 (Large-scale Synchrotron Radiation Facility, figure 6.22), fosters intellectual activities, takes measures to upgrade and renew research facilities, and develops the infrastructure necessary to better distribute research information. Another important facility to improve the performance of R&D is the Japan Patent Office (JPO), which will be explained hereafter.

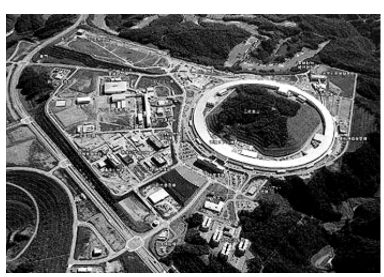


Figure 6.22: The SPring-8 located in the Harima Science Garden City.

Japan Patent Office (JPO)

Nowadays, the JPO processes as many as 420,000 patent applications, making Japan a major patent application power in the world and ensuring that the intellectual property rights system, including the patent system, continues to grow in importance. It is inevitable that Japan, lacking in natural resources, should manifest its scientific proficiency in order to survive fierce international competition. In order to do so, it is imperative for Japan to establish an 'intellectual creation cycle', which aims at developing a system to generate high-quality technology, rapidly protect that technology, and prepare an environment for the utilization of that technology.

Since July 2002, policies for intellectual property have been executed at high speed, in accordance with the Intellectual Property Policy Outline, including the establishment of the Basic Law on Intellectual Property, the launching of the Intellectual Property Strategy Headquarters, and the formulation of the Strategic Program for the Creation, Protection, and Exploitation of Intellectual Property.

In order to live up to such expectations, the JPO strives to realize a "patent system which executes timely and high quality examinations of patent applications and is globally recognized as the foremost patent system in the world". The final goal is the elimination of the waiting time until, for instance, the first office action. Patent applicants will be able to know soon after filing whether or not the applications can be patented, which will give companies important information to decide the future investment of R&D resources into more promising research areas. At present, the budget for R&D in private companies in Japan totals approximately 12 trillion Yen (89 billion Euro). However, 49% of the applications for patents requiring examination submitted from private companies are rejected. According to rough estimates, half of the private division's R&D expenses have not resulted in patents. From this viewpoint, decreasing the period of waiting for the first office action is important for increasing R&D efficiency [146].

The Netherlands

Non-academic research institutes and private firms have high citation-impact scores. The Netherlands has numerous well-known (semi-)public research institutes such as TNO, active in fields ranging from nutrition to industrial technology, DLO (the governments Agricultural Research Department, now merged with the University of Wageningen into the Wageningen University and Research Centre), the GTIs (Large Technology Institutes) and RIVM (the National Institute of Public Health and the Environment). In addition, both NWO (Dutch Organisation for Scientific Research) and KNAW (Royal Dutch Academy of Science) run a diverse set of research institutes. Many of these non-university institutes are involved in cutting-edge basic research, actively publishing in the international scientific literature, and achieving citation impact scores that range from average to excellent.

But the Netherlands probably will not reach the EU-norm which is defined in

Lissabon, to become the biggest knowledge economy in the world. A huge lack of high educated people is predicted. The increase of the level of education in the Netherlands has dropped significantly in the last few years compared to the the period between 1980 and 1995. Especially the divisions where a shortage was reported on available employees this gap increased [147].

Design, management and market knowledge are becoming more and more important in the realization of successful innovations. Research and development are essential factors, but their relative share is decreasing. This claims an advise of the Consultancy board for Science and Technology policy (AWT) to the Dutch parliament. The AWT claims that the level of knowledge is quite good, but the use of that knowledge is poor. Government policy should not extra stimulate knowledge development because the Netherlands is already strong in that division. But applying knowledge in innovations needs a lot of attention and a strong policy. According to the AWT, Dutch people are taking less risks, are less enterprizing and the innovation network does not function properly. The small and medium companies should take more profit of higher education and the knowledge that is developed there. Finally universities could cooperate more [148].

6.5.4 Firm strategy, structure and rivalry

Founders of the R&D institutes are the government and large companies. Some institutes originated from the merging of different divisions of companies. The institutes that are responsible for the main part of of R&D in the division of innovation related to electrical engineering and their main issues will be described below.

Rivalry is a very important factor in the division of R&D, because it can lift the R&D to a higher level and thus improve the performance.

Japan

In Japan, the next institutes are responsible for the major part of R&D in the division of innovation related to Electrical engineering:

- Institute for Future Technology (IFTECH)
  The blue print for IFTECH [149] was drawn up by a special study mission on industrial forecasting organized in 1969. Following a close survey of leading US think tanks, the mission recommended the creation of an independent, future research institute focused on science, technology and industry within a comprehensive spectrum encompassing the social and natural science.

- Mitsubishi Research Institute, Inc. (MIRI)
  Mitsubishi Research Institute, Inc. [150] is a research and consulting company headquartered in Tokyo. Since their founding in 1970, MIRI has been committed to assisting their clients in developing solutions to meet their distinctive needs in virtually every division from Communications & IT to

Transportation. Mitsubishi Research Institutes Science & Technology team is dedicated to engaging in projects related to Life Sciences, Nanotechnology and Materials Science.

- Fuji Research Institute (F-RIC)
  Fuji-RIC [151] has two broad functions: research & science and system solutions. Through collaboration between both areas, five major strengths are offered: Research, Consulting, System Integration, Outsourcing and Science. By combining each of these skills organically, clients are provided with optimal, total solutions.

- SPring-8
  SPring-8 [152], which is the world's largest third-generation synchrotron radiation facility, provides the most powerful synchrotron radiation currently available. SPring-8's ultra-brilliant synchrotron radiation gives researchers exciting opportunities for advanced research in materials science, spectroscopic analysis, earth science, life science, environmental science, industrial applications and so forth. The Japan Synchrotron Radiation Research Institute (JASRI) is responsible for the management, operation and development of the facility.

- Research Institute of Electrical Communication (RIEC) at the Tohoku University, Sendai
  The Research Institute of Electrical Communication [153] is a unique university-run research institute in Japan that is dedicated to the research on communication and information processing. It comprises three research divisions with 24 subsections (including 3 visitor subsections) and an experimental facility with 3 subsections, each subsection being headed by a professor. In 1994 the Institute was designated as National Center for Cooperative Research aimed at the realization of 'barrier-free communication' technology.

- Akita Research Institute of Advanced Technology (AIT)
  AIT [154] functions as a public research institute are to promote original research in technology areas of high potential for future growth of the local industry, as well as themes which are expected to have wide ranging effects on industry in Akita. AIT is presently carrying out the research on an ultra-high density perpendicular magnetic recording system in co-operation with the Research Institute of Electrical Communication of Tohoku University and Prof. Shun-ichi Iwasaki, President of Tohoku Institute of Technology, who is the inventor of the system and honorary director of AIT.

- Intelligent Systems Institute of AIST Tsukuba
  The objective of the Intelligent Systems Institute [155] is to conduct research on fundamental and component technologies, system integration technologies for the computer-oriented intelligent systems, and also physical systems which support human activities in the real world. In the 21st century information and computer network technology is one of the key technologies to improve human life. Also the IT driven systems that provide physical

services to human will be important. In order to guarantee sustainable prosperity in our society in the future, the institute promotes advanced R&D's relating to computer & information science, robotics and mechatronics.

- The Earth Simulation Center
  To build a harmonious relationship between the Earth and human beings, the Earth Simulator Centre [156] will endeavor to achieve the maximum benefit of the Earth Simulator's capabilities and will pursue challenges in various areas of research and development. Through collaboration with various national-related agencies and industries and with the support of the Japanese nation, the Earth Simulator Project is dedicated to serving society.

The institutes are occupied with a variety of issues. The most important ones to our interest are listed below:

- Next-generation robot utilization project;
- Next-generation high-speed (wireless / mobile) communication equipment technological development project;
- Laminated memory chip technological development project;
- Next-generation semi-conducting material and process basic project;
- Quasi-zenith satellite system basic project;
- Biotechnology;
- Laser technology;
- Chemical technology;
- Nanotechnology;
- Investigative research;
- Space Solar Power System;
- Future Technology Trends on National Defense;
- Magnetic wave simulations;
- Opto-electronics;
- Micro-machines (MEMS);
- Semiconductor device design;
- Molecular electronics;
- Materials, and electron beam applied technologies;
- X-ray applied technologies and complex system analysis;
- Complex systems and next-generation computational science.

Rivalry

Nowadays, with the developments in IT and the spurt in cross-border corporate activities, the world economy is facing a period of mega-competition. The world has entered a phase of shifting from competition centred on developed nations to competition that includes developing nations, and in which international competition will further intensify. Against this background of new countries and regions making inroads into the world economy, companies are seeking the optimum environment, and making capital and personnel move drastically. Cross-border alliances of institutes, corporatist and corporate takeovers are also gaining momentum.

The process by which innovations are generated is related to a variety of factors outside companies and institutes, and the combinations of these are referred to as innovation systems. In the process by which technology is commercialized and launched onto the market, the social and economic systems, which are different in individual countries, have a great impact. Therefore the innovation systems of countries are referred to as national innovation systems (figure 6.23).

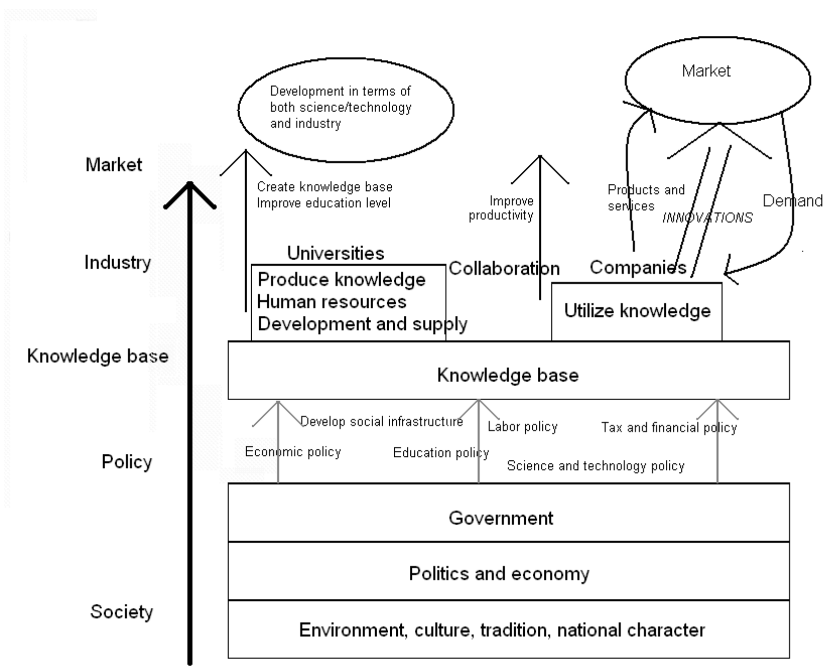


Figure 6.23: National innovation systems.

Against the background of intensifying world competition, initiatives are underway with the awareness not merely of increasing the quantity of research and development resources such as research expenditure and research personnel, but of correcting systematic defects that lower the relative efficiency of research and development efforts and thus hamper the innovation. In engaging in such initiatives, it is necessary to incorporate the outstanding parts of the innovation systems of other countries, and establish national innovation systems best suited to the countries concerned.

The Netherlands

In the Netherlands, technological institutes like TNO, GTIs and DLO are having a key role in promoting the connections between knowledge development and the usage of that knowledge. Their prime assignment is performing applied research in the order of companies and the public division. At the same time, they have to contribute on the implementation of scientific knowledge by qualitative advising. In the current society, they have their own role in improving the link between universities and the social requests. In order to perform well in that role, institutes have to maintain both with companies, universities and society organizations. Only then they are able to make use of the most recent insights and of knowledge generated by the universities. The Dutch government supplies the technological institutes with a basic subsidy and on top of that a subsidy focused on the specific area the institutes are on. Customers have to pay the research costs themselves.

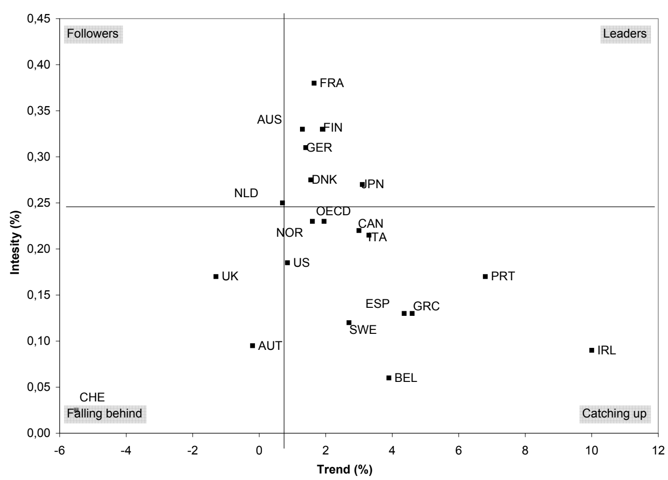


Figure 6.24: R&D performance of different countries.

R&D performance by Dutch research institutes is close to both the EU-15 R&D intensity and the EU-15 average growth performance (figure 6.24). This division covering the non-business research institutes has been one of the strongest chains in the Dutch R&D system for many years. Among the larger research institutes is TNO, which spends 370 million Euro on R&D in 2001, making it the third biggest R&D spender in the Netherlands. Only Philips and Akzo Nobel spent more on R&D.

In figure 6.25 it is clear that the Netherlands spend a relative large share on ap-

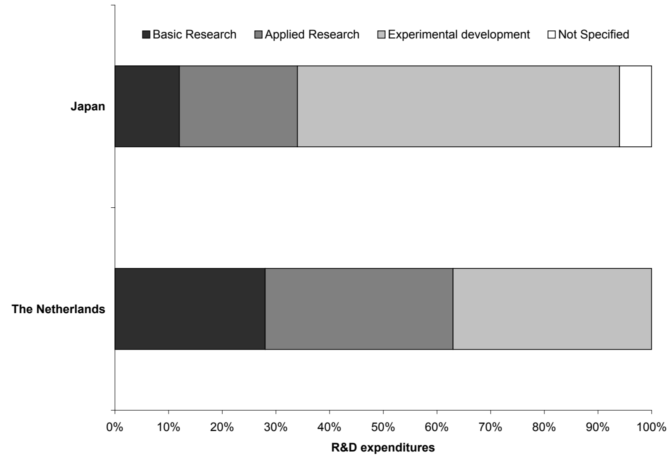


Figure 6.25: R&D expenditures for Japan and the Netherlands.

plied research compared to Japan.

Technological top institutes

The Ministry of Economics and the Ministry of Education have established four technological top institutes in 1997. In these institutes companies and knowledge centres work together at basic-strategic research and the acquired knowledge is public. The four above mentioned institutes are briefly described below:

- Dutch Polymer Institute (DPI)
  DPI [157] is a public-private-partnership between the main polymer producing and processing industries in the Netherlands and knowledge institutes (universities and TNO) that have a track record in the research of polymers and polymer processing. DPI focuses academic research on issues that are relevant to polymer industries. The research is characterized by a strong multi-disciplinary ‘chain-of-knowledge’ approach. The main participating knowledge institutes are the Universities of Groningen, Twente, Eindhoven and Delft and TNO. Over the last years DPI has become increasingly active outside the Netherlands. Universities in Germany, Italy, UK, South Africa and Greece have already joined DPI. It is anticipated that the number of non-Dutch research groups involved in the DPI programme will grow the coming years.
- Wageningen Centre for Food Sciences (WCFS)
  During the last five years, WCFS [158] has done work in the three research areas selected for their future relevance to the food industry partners. Research on links between health and nutrition is of increasing significance as industry partners move towards developing functional foods. Fundamental

research that opens new horizons on consumer perceptions of food texture is highly relevant to WCFS industry partners as demand grows for healthy food that looks and tastes good. More knowledge about the role microbes play in food flavour and texture, as well as food shelf life and their contribution to gastrointestinal health is self-evident.

- 'Telematica Instituut'
  'Telematica Instituut' [159] is a unique partnership between the business community, research centres and government, to perform research in the field of telematics for the public and private divisions. The emphasis is on rapidly translating fundamental knowledge into market-oriented applications. The institute's objective is to strengthen the competitiveness and innovative strength of Dutch business, as well as improving the quality of our society through the proper application of telematics. To achieve this, the institute brings together leading researchers from various institutions and disciplines. The Dutch government supports 'Telematica Instituut' under its 'leading technological institutes' scheme. The institute is managed and funded by top companies such as IBM, KPN, Lucent Technologies and ING. At the same time it combines the strengths of various well-known centres of expertise, such as the Universities of Delft, Tilburg and Twente, CWI and TNO.

- The Netherlands Institute for Metals Research (NIMR)
  The mission of the Netherlands Institute for Metals Research (NIMR) [160] is to improve the competitive position of the Dutch metals industry by carrying out strategic research in the field of metals science, metals production and metals engineering. Six focus areas have been selected for the NIMR programme which are metal forming and welding (manufacturing technologies), steel and aluminium production processes (metals production) and surface engineering and corrosion (lifetime properties). These activities are supported by a Core Programme that addresses a number of fundamental issues. It combines the strengths of various well-known centres of expertise, such as the Universities of Delft, Tilburg and Twente, and TNO.

Beside these top institutes, the Netherlands have a variety of institutes and universities that work in the most diverse areas of technology.

6.5.5 Related and supporting industries

This paragraph describes some related and supporting industries, which try to improve the performance of the research and development. There is one particular, important ministry in Japan which supports the activities of research institutes, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and will be discussed hereafter. The main supporting industry in the Netherlands is the recently installed "innovation platform".

Japan

As mentioned above, the main supporting industry in Japan is MEXT. The structure and its main activities will be discussed below.

MEXT

The general account budget of the national government for 2003 amounted to 81,789.1 billion Yen (606 billion Euro). The MEXT budget allocation amounted to 6,322 billion Yen (47 billion Euro), accounting for 7.7% of the general account budget of the national government. The special account budget for national educational institutions came to 2,804.5 billion Yen (21 billion Euro), of which 1,525.6 billion Yen (11 billion Euro) was received from the MEXT general account budget. The special account budget for electric power development promotion measures is 149.1 billion Yen (1.1 billion Euro). MEXT's budget is used to improve and promote education, science and technology, sports, culture, and includes the payment of school staff, the development of educational facilities, the promotion of science and technology, and financial assistance to private schools and scholarships.

MEXT focuses on basic and fundamental research and development activities of a comprehensive nature which goes beyond the jurisdictions of individual ministries and various categories in order to make contributions to a wide range of areas, such as the realization of an advanced information society, improvement in the quality and diversity of the food consumed by the people, and overcoming disease.

Aiming to foster the creation of intellectual assets that will lead to the science and technology of tomorrow, MEXT operates programs such as the Core Research for Evolutional Science and Technology in order to promote basic research. MEXT furthermore takes the following measures in order to promote comprehensive research and development activities across the nation and to foster the creation of new industries and improve the welfare of the people. In order to respond to the growing social demand for the promotion of research exchanges, MEXT has established the Law for Facilitating Governmental Research Exchange and other systems for joint research and commissioned research in order to grow cooperation among industry, academia and the government. MEXT has also established the Tsukuba Centre for Institutes to promote research exchanges activities, and the Centres for Cooperative Research in the national universities to grow cooperation among industry and academia.

In order to promote research of the highest international standard and foster new scientific creativity, MEXT is promoting the establishment of flexible research organizations and systems responding to scientific research trends and social change while ensuring that each of the diverse scientific research organizations has an appropriate role and mission [161].

MEXT promotes research and development in the information science and technology division, beginning with the development of the Earth Simulator, the world's fastest system of its kind. In the life sciences division, MEXT undertakes research into such areas as the human genome, the brain, cancer, and development and regenerative science and plant sciences. In the materials science division, MEXT undertakes research and development into high-strength and long-life materials, eco-materials, and other materials, in order to serve as the foundation for a variety of scientific fields, such as the two divisions mentioned above. Through research in particles and radiation, MEXT is pursuing ways to make beneficial use of radiation in society and conducting research into the nucleus and elementary particles using accelerators. MEXT is also promoting the management of radioactive waste originating from research and medical use [161].

In order to put the excellent research results to practical use and to ensure social benefits, MEXT supports the patenting, enhancement, and utilization of research results, provides assistance to projects to encourage new inventions, and approves the Technology Licensing Organization.

There are three bureaus within MEXT which directly connect to Research and Development in Japan. These are:

- The Science and Technology Bureau;
- The Research Promotion Bureau;
- The Research and Development Bureau.

The Science and Technology Policy Bureau is responsible for the planning and drafting of basic science and technology policies. The bureau is also responsible for the formulation of research programs and promotion of research evaluation, training of researchers and technicians, regional science and technology promotion, increasing the understanding of science and technology, the promotion of a comprehensive policy on international research exchange, and duties related to safety systems for experimental nuclear reactors and radioactive isotopes. The Government has laid out the Science and Technology Basic Plan (Cabinet Decision on July 2, 1996) in order to promote comprehensive and systematic measures related to the advancement of science and technology. For the five-year period between 1996 and 2000, specific policies and measures have been formulated from a ten-year perspective. The next Science and Technology Basic Plan, which is targeted for the five years between 2001 and 2005, has been under study since August 1999 in four working groups established within the Council for Science and Technology's Committee on Policy Matters [161].

The Research Promotion Bureau is responsible for the formulation of policies to promote cross-field research such as encouraging inventions, promoting the application of research results and cooperation among industries, academia and government, improving the research environment and R&D infrastructure by, for example, enhancing the research information infrastructure, and performing work relating to fundamental research. The bureau also formulates policies to promote scientific study, including the establishment of scientific institutions and the provision of assistance for scientific research, and performs work relating to basic and fundamental research and development in such areas as IT, life science, and quantum and radiation research.

The Research and Development Bureau is responsible for promoting research and development centred on large-scale projects, such as research and development into disaster prevention, earthquakes and volcanoes, the ocean and the earth, the promotion of South Pole observation, the International Space Station Program and other research, development and utilization of space, and research into nuclear fusion and nuclear power technology, including the development of nuclear fuel cycles. The Bureau is also responsible for areas related to nuclear energy policy, including the peaceful use of nuclear energy [161].

The Netherlands

In the Netherlands, there is an agency which supports the institutes, too. This is the recently installed "innovation platform", and functions as a link between (the different bodies of the) government, consumers, industry and education. The innovation platform has written an innovation letter, to make their objectives clear. Key points of that letter state that the Netherlands have to improve their innovation climate, make sure that more companies start to innovate and by focusing on strategically innovation areas utilize innovation chances. It is not as extensive as MEXT from Japan, but has manly the same objective: stimulate innovation.

6.5.6 Government

The government is very concerned in developing a country's R&D performance, because the economy depends, among other things of course, on R&D.

Japan

After the bursting of the economic bubble, Japan's economy showed signs of recovery. However, the recovery has already ended and deteriorated once more. Companies are therefore holding back on capital investment. In this situation, Japan's economic growth is at the lowest level among developed nations. Meanwhile, other Asian countries have overcome the currency crisis of the late 1990s, with some recording unprecedented levels of economic growth. This economic situation also influences the research institutes. Companies and government are more critical about the kind of research and the results.

Innovations bolster a country's economic growth and competitiveness. Therefore in recent years a large number of countries have started national initiatives to create innovations, instead of leaving the creation of innovations simply to the activities of corporations.

To improve the factor conditions, the Government has laid out the Science and Technology Basic Plan (Cabinet Decision on 2 July 1996) in order to promote comprehensive and systematic measures related to the advancement of science and technology. For the five-year period between 1996 and 2000, specific policies and measures have been formulated from a ten-year perspective. For example, labour and capital availability have attention in the plan and will be discussed below.

Labour policies involve improvement of researchers' mobility and the revitalizing of research and development activities through the introduction of a fixed-term appointment system. Therefore, the plan to support 10,000 postdoctoral researchers and drastically increase the number of research assistants is promoted.

Capital availability is based on the thinking, that investment in government research and development as a percentage of the GDP should be raised above that of other major powers such as Europe and the United States. At the beginning of the 21st century, it is crucial to double expenditures during the period of the plan. To achieve this, it will be necessary to allocate a total of 17 trillion Yen (126 billion Euro) to science and technology related areas during the period of the plan.

The Netherlands

R&D expenditures in the Netherlands are, measured in respect to R&D intensity, comparable to the focus countries, although the last few years growth of real R&D expenditures lagged. The Netherlands are threatened to lag in both expenditures on Dutch knowledge institutes in the semi public division as well for public universities. However, the expenditures on fundamental research in the Netherlands are larger than those of the focus countries. But, on the other hand, expenditures on applied research and development are lagging compared to those countries. Because of that, the knowledge transfer from fundamental research to new concurring products and services is in danger. Other good news is that de public-private cooperation in the Netherlands is quite strong. As for financing public research by the business, the Netherlands belong to the front runners. On top of that, the Netherlands showed the largest progression on this topic compared to the focus countries. Within research institutes in the (semi-) public division, TNO is by far the largest R&D executor [162].

6.5.7 Chance

A lot of chance factors can influence the performance of R&D. Some important factors for Japan as well as the Netherlands will be discussed.

Japan

Japan is very well known with earthquakes, because the country lies above a fracture line of earth plates. Although earthquakes can destroy institutes or parts of the research that is done, it also can stimulate research and development. This contains earthquake contingency planning, utilization and application of new technologies for crisis management, development of disaster-management tools, educational programs, pollution and environmental issues. Furthermore, Japan has troops stationed in Iraq. Because different divisions in a country influence each other, certain decisions, for example politic, can have consequences for the R&D division and its environment. In 2005, EXPO2005 will take place in Japan. At this special occasion, technology and technology development in Japan gets much attention from abroad. This could give a positive impulse to institutes and research centres. Foreign investors and scientist could be attracted.

The Netherlands

In the past, the Netherlands have suffered from heavy flooding. There has always been a struggle against water, which has led to big innovations on that topic. The Netherlands has the advantage of being the main entry of Europe by water. In Rotterdam one of the largest container ports of the world is settled, which has led to a variety of innovations and is still a large motive to continue the innovation process.

6.5.8 Comparison and conclusion

This paragraph shows a comparison on some important factors, related to research and development, between Japan and The Netherlands and gives a conclusion.

	Japan	The Netherlands
% of GDP in R&D	>3% of GDP in R&D	<2% of GDP in R&D
Research focus	Focus on experimental development	Focus on basic and applied research
Research objective	Objective: R&D expenditures as % of GDP larger than other major powers	Objective: within 10 years one of the leaders in innovation

Table 6.12: Comparison table on division 73.

The Netherlands and Japan both want to be at the front of world leading innovative nations. The big difference is that Japan also takes the efforts to reach this goal and is quite successful in reaching it. Expenses and investments in high technology research are growing for years, unlike the Netherlands where it is stable or decreasing.

The institutes in Japan and the Netherlands both deliver research of high quality. But the impression is that the quantity of research in Japan is higher. One of the reasons for this is that the Japanese government strongly stimulates research and developments. Also the Japanese Patent Office is making efforts to make innovation development as smooth as possible. Although the economy in Japan is not very strong at the moment, government and companies believe that innovations are a strong and long term solution to make the economy healthier. It seems that Japan, as a whole, thinks and knows investments in innovation are important. In the Netherlands, companies and government create the idea that they are very careful to invest in innovation. However investments in basic research are higher than much other countries and the cooperation between public and private divisions is strong. For both countries, the research facilities are of high quality, but in Japan the quantity is better. On top of that, Japan is more focussed on the development of products, while the Netherlands is more obtained with basic and applied research. In other words: the basics in the Netherlands are better, but in Japan products are developed and that is in the end what innovation is about.

It seems that Japan can maintain the international competitive innovation position it has acquired. The work done on this is of high level and investments and spirit give some guarantees for the future. The Netherlands has to fear for their position. The Netherlands were always at the front of innovation but seem to slide away further and further. In order to keep up with Japan, big efforts have to be made in the future by the Netherlands.

6.6 Division 80

by Dirk van Schaijk and Jos Ansink

6.6.1 Introduction

This section describes division 80, the division of "Education" and it will discuss class 8030, which is the class of higher education [99]. Furthermore the influence of higher education on technical innovation is discussed.

Although Porter's Diamond is not ideal to perform the analysis on education, nevertheless it has been done. Porter's Diamond is in fact an economical model and is therefore difficult to apply on education. For education, it is better to analyze and compare on cultural aspects rather than economical ones. One could argue to use another model based on cultural aspects, like the I-CUE method [163]. However, none of the other models we have found has proven to be better. Therefore Porter's Diamond has been used, as in the analysis of the other divisions in this book. The different determinants will be discussed, but the comparison is based on cultural aspects instead of economical ones.

The emphasis in this section will be on education in Japan, because the educational system in the Netherlands is supposed to be known. For an overview of the Dutch educational system, the reader is referred to [164] or [165]. This section starts with an overview of the organization of education in Japan, followed with an overview of the higher education. After that, as in the previous sections, it shows an analysis of the higher education division using Porter's Diamond. The section ends with a comparison and conclusion.

6.6.2 Organization of education in Japan

All Japanese children begin their educational development in pre-school. Preschool starts when children are at the age of three years and it is almost the same as the kindergarten in the Netherlands. After 3 years Japanese children enter the first grade of elementary school in the month April after their sixth birthday. There are around 30 to 40 students in a typical elementary school class. The subjects they study include Japanese language (hiragana, katakana and simple kanji), mathematics, science, social studies, music, crafts, physical education, and home economics (to learn simple cooking and sewing skills).

The children in Japan have to spend a lot of time on learning Japanese writing, because it is not easy to learn two different phonetic alphabets: the hiragana, katakana, and the Chinese characters (kanji). The hiragana and katakana both have 46 characters and there area a lot of Chinese characters. To be able to read a paper one needs to know about 2000 kanji. When leaving the primary school, one will know about 1000 kanji.

Children also learn traditional Japanese arts like shodo (calligraphy) and haiku.

Shodo involves dipping a brush in ink and using it to write kanji and kana (hiragana, katakana) in an artistic style. Haiku is a form of poetry developed in Japan about 400 years ago. A haiku is a short verse of 17 syllables, divided into units of five, seven, and five syllables. It uses simple expressions to convey deep emotions to the readers.

Primary school takes until sixth grade. The children learn English for the first time in sixth grade, however, the children still can not pronounce it very well. This is because of the phonetic difference between the alphabets. In English, there are letters and sounds Japanese cannot pronounce. However, reading and writing English is not a real problem for the Japanese [166].

School life

In Japanese elementary schools, classes are divided into small teams for many activities. For example, as part of their education, every day the students clean the classrooms, halls, and yards of their school in these teams. In many elementary schools, the students eat lunch together in their classrooms, enjoying meals prepared by the school or by a local 'school lunch center'. Small teams of students take turns to serve lunch to their classmates. School lunches contain a rich variety of healthy and nutritious foods and students look forward to lunchtime.

There are many school events during the year, such as sports days when students compete in events like tug-of-war and relay races, excursions to historical sites, and arts and culture festivals featuring dancing and other performances by children. Students in the highest grades of elementary, middle, and high schools also take trips lasting up to several days to culturally important cities like Kyoto and Nara, ski resorts, or other places. Most middle and high schools require students to wear uniforms. Boys generally wear pants and jackets with stand-up collars, and girls wear blazers and skirts.

In Japan, for children it is not possible to repeat a class. If they do not have a good ability to learn they will go to special schools. Children get homework from the beginning of the first grade. Every day they have to write in a diary and submit this to their teachers the next day. When the children get to third grade, they enter a kind of evening-school, the juka, where they make their homework and receive lectures. This is to prepare them for the entry exams of secondary schools. When they want to go to a good secondary school they have to make an entry exam. Good secondary schools are very important for children that want to go to a good university. For every university in Japan an entry exam has to be done. If students fail the exam can retried two years later. So it is hard to get into a university. However, almost no students fail once they are at university. The organization of the school system in Japan is described in table 6.13.

In table 6.14, the distribution of students over the different stages of education is shown, such as: kindergarten, elementary school, secondary school and higher education.

	Pre-elementary education			Elementary education						Secondary education						Higher education					
School years				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Age	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Table 6.13: Organization of the school system in Japan.

Type of institution	Nr of institutions (schools)				Nr of students (persons)				Nr of full-time teachers (persons)			
	Total	National	Public	Private	Total	National	Public	Private	Total	National	Public	Private
Kindergartens	14279	49	5820	8410	1769096	6804	363281	1399011	108051	322	25866	81863
Elementary school	23808	73	23560	175	7239327	47238	7124712	67377	410505	1776	405453	3276
Lower secundary school	11159	76	10392	691	3862849	33544	3597997	231308	253954	1647	239923	12384
Upper secondary school	5472	15	4136	1321	3929352	8858	2773619	1146875	262371	594	200797	60980
Secundary school	9	2	2	5	3020	1422	319	1279	257	89	46	122
Schools for the blind	71	1	68	2	3926	182	3657	87	3449	87	3325	37
Schools for the deaf	106	1	104	1	6719	268	6385	66	4920	90	4800	30
Schools for the other disabled	816	43	761	12	83526	2623	80212	691	51497	1261	50040	196
Colleges of technology	62	54	5	3	57349	50483	4635	2231	4465	3909	394	162
Junior colleges	541	16	50	475	267086	5800	18834	242452	14491	534	1691	12266
Universities	686	99	75	512	2786032	621487	116705	2047840	155050	60930	10860	83260
Specialized training colleges	3467	99	215	3153	765558	12684	32283	720591	39062	765	2748	35549
Miscellaneous schools	2069	0	31	2038	198588	0	1771	196817	12185	0	120	12065
Total	62545	528	45219	16798	20972428	791393	14124410	6056625	1320257	72004	946063	302190

Table 6.14: Number of institutions, students and teachers.

6.6.3 Organization of higher education in Japan

The institutions for higher education in Japan consist of: universities, junior colleges, colleges of technology and specialized training colleges (specialized schools), which offer specialized courses. The advancement rates of the different institutions are shown in figure 6.26. Since the end of World War II, higher education in Japan has expanded remarkably, particularly concerning the number of private institutions.

Universities and graduate schools

The purpose of universities, as the centers of advanced learning, is to provide students with wide-ranging knowledge and to conduct in-depth teaching and research in specialized academic disciplines. The term of study is in general four years, but six years for medicine, dentistry and veterinary medicine. Graduates are awarded a bachelor's degree. A university may also establish a graduate school offering master courses (two-year standard term of study), doctoral courses (in general five-year standard term, but four years for medicine, dentistry and veterinarian medicine) or professional degree courses (two-year standard term of study, but it can take between one and two years or more than three years). Those who have completed the graduate course are awarded either a master's, doctoral or a professional degree.

Junior colleges

The purpose of junior colleges is to conduct in-depth learning and research in specialized disciplines and to develop abilities necessary for employment and daily life. The term of study is two or three years and the graduates are awarded the title of associate. The purpose of the colleges of technology is to conduct in-depth learning in specialized disciplines and to develop a student's abilities necessary for employment. Colleges of technology, unlike universities or junior colleges, admit graduates of lower secondary schools. The term of study is five years (five years and half for mercantile marine studies) and graduates are awarded the title of associate.

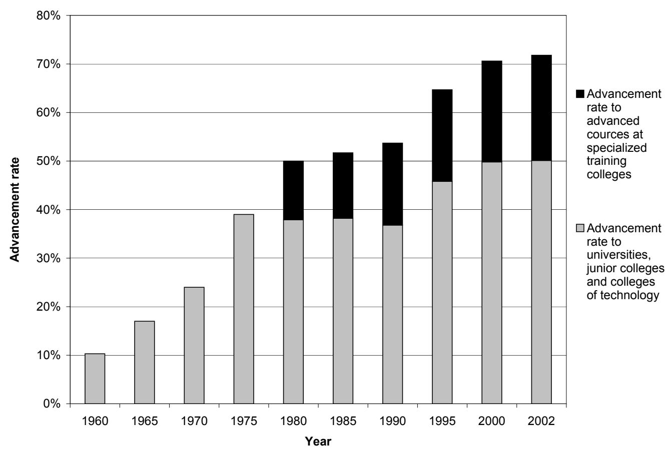


Figure 6.26: Advancement rate to institutions of higher education in Japan.

Culture of higher education

For students, higher education is not a continuation of the intense learning environment that they experience through high school. The role of universities in generating and imparting knowledge is less important than their capacity to define social status. Accordingly, the prestige of a university is more important than the quality of education itself.

Compared to the time and effort spent in order to qualify for an advanced study, studying at university is far less demanding than previous education. Social constraints put the school administration and faculty in a position where they feel obliged to secure the graduation of students. Students that have failed the entry exam of a national university, and thereby an elite status, usually join a private university. Students at national universities need to establish good academic records after two years of general study, to compete for choice career assignments

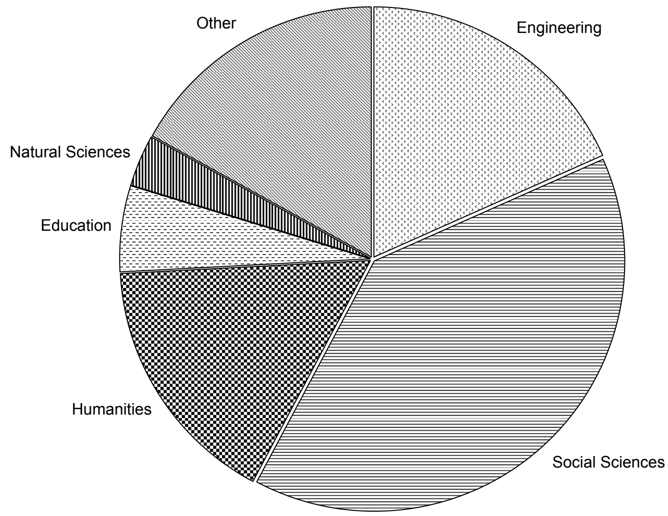


Figure 6.27: Percentage distribution of (undergraduate) university students by major fields of study.

in business or public service. Also technical schools, like engineering schools, are more demanding of students than liberal arts schools. Here the differentiation between formal education and vocational aptitude is more apparent.

Since the Japanese students in higher education generally have a lot of free time, much of it is spent on other activities than studying. In the 1950s and 60s, one of those activities was politics, particularly of the radical left-wing variety. Mass public demonstrations were held against at a wide range of issues, a favorite being American foreign policy which was regarded as imperialism. Today, students have turned to more mundane activities like social clubs. These clubs emphasize group loyalty and personal discipline and usually involve athletics or recreational activities. A rather new phenomenon is drinking and other social diversions, since universities do not have on-campus housing, which makes it difficult for students to spend considerable time together. Another factor that inhibits socializing are the sometimes long travelling times between the university and the student's homes as some students may spend as much as four hours each day on travelling.

History of higher educational system

Well known is the fact that Japanese schoolchildren have to work very hard to get to good schools. The basic school system is very similar to that of the United States, which is no surprise, because Japan was occupied and for a great deal reformed, by the United States after the Second World War. After the war, Japan grew to be an incredible economical power and much of this accomplishment can be atoned to the educational system in Japan. This educational system was responsible for the highly skilled workforce.

The Japanese students collectively score at, or near, the top on standardized math and science exams. Japan's population in general, is almost totally literate in a language of daunting complexity. These accomplishments are a credit to the Japanese people and to the effectiveness of their educational system.

The higher education, which is our main focus, has a long history. Before the Second World War, higher education was small in size, very selective in its admissions and elite in its product. Before the restoration in 1868, various research and teaching institutions like the institute for the study of barbarian documents, Buddhist monasteries and private schools could be called higher education in the modern sense. This high level of education and national culture during the Edo period (1603 - 1867) is believed to be responsible for the rapid modernization of Japan [161]. Thus it seems logical to examine the history of education in Japan.

The samurai

A distinctive feature of the Edo period was the traditional division of classes into samurai, farmers, artisans and merchants of which the samurai held the most power. Distinctive schools were developed for each class, the so called fief schools (hanko or hangaku) for the samurai, and the terakoya for the commoners.

Samurai families originally availed themselves of the services of priests in Buddhist temples for their education. However by the Edo period, this class began to employ Confucian scholars to act as preceptors in fief schools they founded in the castle towns. At the end of the Edo period there were about 270 of these schools. The Shoheizaka Gakumonjo, alternately called the Shoheiko, under the direct control of the Shogunate at Edo, became the highest seat of learning in its time as well as a model for all the other fief schools. The original institution was the training center of the Confucian temple (koshibyo). It had been established on a site at Ueno in Edo by a Confucian scholar of the Chu Hsi school, Hayashi Razan (1583-1657), under the auspices of the Shogunate government. Later on, this was relocated at Yushima, where an Athenaeum was constructed known as the Yushima Temple. This school started first as a semiprivate, semigovernmental organization under the protection of the Shogunate. It was not long, however, before the government recognized the necessity of direct control over these educational facilities and in 1797 the school was brought under the immediate supervision of the central authorities.

Origin of the private institutions

Many schools had originally been private institutions for Chinese studies (kangakujuku) and were enlarged and reorganized to form fief schools. Furthermore, their curriculum was gradually expanded. In addition to Chinese studies, National Learning and other subjects were introduced and toward the end of the Edo period Western learning and medicine were also offered. At the same time, the trend toward military subjects grew more pronounced and thus there arose a special relationship between literary studies and martial arts. Another type of school which existed independently from the fief schools and the terakoya was the private school (shijuku). These were generally set up in the residence of the instructor for the purpose of instruction in academic subjects and artistic accomplishments. The origin of the private schools goes back to the 'secret schools' of ancient and medieval times, where a particularly close relationship existed between the teacher and the student and the object of instruction consisted in the transmission of confidential material relating to particular sects.

However as the years went by, these private schools assumed a more open character and reached a stage of development from which conditions for modern education could be derived. The private schools in operation during the later years of the Shogunate did not come under the control of the Shogunal or fief authorities, but rather operated as independent entities. The private schools differed from both the fief schools and the terakoya in that they made little, if any, allowances for students of different social status. Common educational facilities were provided by the private schools for both the samurai and the commoners. They were the forerunners of the modern private schools.

Meiji restoration

At the beginning of the Meiji period (1868 - 1912), the basic policy of the new government was made clear in the Imperial Oath of Five Articles (Gokajo no Goseimon) declared by the Emperor on April 6, 1868. Each of the five articles of the Imperial Oath had an important bearing on education, and Article 5, "Knowledge shall be sought throughout the world in order that the welfare of the Empire may be promoted", clearly specified the goal of modernizing national education through introducing modern Western civilization. The Kaiseijo, which had been the principal official institution for Western learning in the Edo period, was restored by the new government in October, 1868, with the new name of the Kaisei Gakko. In the Edo period, the institution's faculty was composed of Japanese teachers with one exception, Koenraad W. Gratama (1831-1888), who was a Dutch teacher. However after the Meiji Restoration, the new government employed several foreign teachers to teach English, French and German languages at the Kaisei Gakko. In 1871 the fiefs were abolished and the government established the Department of Education which centralized all of the national educational activities.

History of the national universities

The first real university was established in 1877 in Tokyo and was called the Imperial University in 1886. Its main task was to look into "abstruse principles of learning in accordance with the needs of the state". The bureaucratic elite in Japan consisted mainly of graduates of the law faculty of this university. Nowadays this is still the case, because the imperial university order of 1886 released the graduates of civil service entrance exams. Entrance exams for most professions are still common today. Afterwards, other universities in Kyoto and elsewhere were established and in 1903 ‘professional schools’ (a type of university) were allowed to provide advanced instruction in the arts and sciences. The university order of 1918 granted university status to private and prefecture or municipal institutions, but few men and even fewer women had the opportunity to study at these institutions. Only the intellectually gifted were chosen and they assumed important positions in society, much like the system in Europe in those days, which was in fact imitated. These educational systems were designed to create an educated workforce to meet political and economical needs and not to create broad opportunities for social development.

Other reforms in higher rducation

During the 1920s, students were attracted to leftist philosophies inspired by the Russian Revolution and economical problems at home. To promote orthodox beliefs, the government created the Ideological Control Bureau in 1934, followed by the National Instruction Bureau in 1937. To further promote proper orientation towards the state, a Research Institute for National Spirit and Culture and an Educational Reform Council were created. The activity of these institutions was enlarged during World War II, to further promote ideology orthodoxy.

After the war, educational philosophy underwent fundamental transformations. The American occupation authorities completely changed the educational system to turn the Japanese society away from its imperial roots to a democracy. The result was a Report of the First US Education Mission to Japan, which contained three principles: equal opportunity, broad knowledge aimed at personal enlightenment and respect for academic freedom and autonomy. In higher education, this meant curriculum revision. For example, greater emphasis was placed on social science and humanities. To make higher education more available for the general public, additional universities were created and existing colleges were upgraded. In the 1960s the enrollment at the university level suddenly increased because of the rapid developing economy. This new system had two results. The first one was an overall decline in quality of higher education, since the new curriculum was less demanding and the expansion of the enrollment meant students with lesser abilities were accepted. The second result was the survival of the elitist aspect of higher education through a differentiation among institutions based on prestige. The more established institutions had more prestige, especially the old imperial universities like the one in Tokyo and Kyoto. Thus they attracted the students with better abilities. University status correlated with employment status: The more prestigious the university, the better jobs its students could expect upon graduation. This resulted in an intensified competition for admission, which is still a frustrating process for the students of today.

The reforms after the war ended the rigid centralized control over higher education. Private universities were encouraged to develop their own individual characteristics free from government interference. This substantially weakened the control of the Ministry of Education over private universities. Furthermore, the government was encouraged to end its preferential treatment of public institutions. In the 1960s, however, the liberal and democratic ideals of education were lessened because of the growing economy and the related demand for national manpower. Career opportunities and education became more closely joined. Despite the important role of higher education in social and economic affairs, the government has never developed a comprehensive policy that effectively dealt with the problems of education [167].

6.6.4 Porter's Diamond

It is not ideal to use Porter's Diamond for education, because it is an economic model. In economic divisions Porter's Diamond is useful, but in the case of education it is hard to formulate all the different determinants that define the diamond. A comparison based on cultural differences could give a better result, but, since we have not found a good alternative, Porter's Diamond is being used as in the other divisions.

Demand

The demand of education can be split in two parts. First there is, of course, the demand of students to enroll into the educational system. Second there is the demand of the labour market for skilled workers. Enrollment in higher education is dependent on the number of teachers, government spending on education and the potential students. The demand of the labour force is dependent on the demand of the government, companies and other institutions that need skilled employees. This part is directly linked to the state of the economy.

Enrollment

First of all, enrollment of students into higher or also called tertiary education will be discussed. As can be seen in table 6.15, the difference between the Netherlands and Japan in number of enrollment is quite striking.

	Enrollment in tertiary education Both sexes			Enrollment in tertiary education Female		
	1998/1999	1999/2000	2000/2001	1998/1999	1999/2000	2000/2001
China	7,364,111	9,398,581	12,143,723	…	3,095,476	…
Japan	3,940,756	3.982,07	3,972,468	1,760,494	1,787,068	1,781,996
The Netherlands	469,885	487,649	504,042	231,629	243,634	254,539
United States	…	13,202,880	13,595,580	…	7,362,121	7,596,436

Table 6.15: Enrollment in higher education in Japan.

When compensated for the population of the country, the numbers tell a different tale: about 3.1% of the total population of Japan enrolls in higher education each

Country	Population estimate
China	1,286,975,468
Japan	127,214,499
The Netherlands	16,150,511
United States	290,342,554

Table 6.16: Population estimations.

year, which is exactly the same percentage as in the Netherlands. These numbers are quite high compared to those of China for instance, which is 0.94%. The United States, however, have an enrollment of 4.7% of the total population a year. The enrollment in Japan is rather stable, in the Netherlands it is still increasing. A quantity used more often to compare enrollment is the Gross Enrollment Ratio (GER) for higher education, which is defined as the total enrollment in tertiary education regardless of age, expressed as a percentage of the population in the five-year age till the secondary-school leaving age-group. Table 6.17 below [168] shows the results for Japan as well as the Netherlands.

	Gross Enrollment Ratio in tertiary education Both sexes			Gender Parity Index for GER in tertiary education Both Sexes		
	1998/1999	1999/2000	2000/2001	1998/1999	1999/2000	2000/2001
Japan	44	46	48	0,85	0,85	0,85
The Netherlands	49	52	55	1,01	1,04	1,07

Table 6.17: GER and GPI for higher education.

The higher GER of the Netherlands could indicate a better throughput from secondary to higher education. In Japan it is not uncommon to spend a year studying to retake the entrance exam of a university at cram schools if one did not pass it the first time. These people are called Ronin and do not fall in the GER-age group, hence the lower GER value in Japan than in the Netherlands. The number of Ronin is estimated to be 400,000 in 1993 [167].

A second striking difference between Japan and the Netherlands is the lower percentage of female students that enroll in higher education, as can be seen in the table above. The Gender Parity Index (GPI) for GER, defined as the ratio of females to males, is much higher in the Netherlands. Also, a climbing trend can be seen here. The women in Japan tend to go to junior colleges.

A trend that Japan shares with the Netherlands is the aging of society and a simultaneous declining of the birth rate. In 1992 there were about two million of age 18 in Japan [169]. In 1999 there were 1.5 million and the number is still declining each year. The result is a higher admittance rate of higher education: in 1996, 73% of the students who applied at universities were admitted against 80.1% in 1999. This process may pose a problem, since the standards of the universities have to be lowered to compensate for the lacking fundamental knowledge and academic skills of new students.

Table 6.18 shows how the types of education are divided in several countries in percentages. The numbers of China and America are mentioned to give some

Country	No schooling	Primary	Secondary	Post-secondary
China	29.3	34.3	34.4	2.0
Japan	0.3	33.6	43.7	20.7
France	0.6	51.1	36.9	11.4
UN	1.2	9.1	44.4	45.2

Table 6.18: Distribution of education.

indication of education throughout the world. The educational level of Japan exceeds most countries. These numbers also indirectly depict the demand from the labour market. The numbers for the Netherlands are as follows:

Type of education	Year	Population (x 1000)	Percentage
'VBO'	1996	1688	
	2000	1606	
	2002	1604	20.8
'MBO'	1996	3427	
	2000	3425	
	2002	3557	46.2
'HBO'	1996	1479	
	2000	1647	
	2002	1752	22.7
'WO'	1996	608	
	2000	745	
	2002	791	10.3

Table 6.19: Type of education for people between 15 and 64 in the Netherlands.

As can be seen in table 6.19 [170], the educational level of the Netherlands is quite high when taken into account that higher education consists of 'HBO' and 'WO'.

Demand from the labour market

In table 6.20 [161] a survey of the division of employment after graduation in Japan is shown. As can be seen, most employees are active in the division of public services. This is not illogical, since Japan does have a lack of natural resources. Furthermore, since most terrain consists of mountains, agriculture is not very well developed.

Type of employment	Number of employed persons
Total	311,495
Agriculture	691
Forestry	53
Fisheries	101
Mining	61
Construction	15,235
Manufacturing	53,57
Electricity, gas, heat supply and water supply	958
Transportation and communication	11,517
Wholesale, retail, and restaurants	63,303
Finance and insurance	29,7
Real estate	5,224
Services	109,847
Public services (not elsewhere classified)	15,002
Miscellaneous	6,233

Table 6.20: Employment of University and College Graduates for Japan in 2002.

Companies tend to look at the score of the entrance exam and the prestige factor of the university when hiring new staff. The unemployment rate, defined as the percentage of the labour force without jobs, in 2003 in Japan was 5.3%, which is the same as in the Netherlands. The difference between Japan and the Netherlands is the distribution of unemployment regarding age. In Japan it is custom to work for one and the same company the rest of one's life. With recent economical setbacks, companies have to cut back and do so by not hiring new staff, since it is unthinkable that older employees are fired. This means the unemployment of the graduates-age-group in Japan is much higher.

The labour environment in Japan is completely different compared to the Netherlands. For example, life long learning in Japan is a normal phenomenon [171]. New employees work in the different (lower) levels of a company in order to get them familiarized with the company culture and to see where their talents lie. After five or six years, one specializes in one aspect, like management, accounting, etc. Eventually every employee will become a director of one compartment, but these titles can be misleading since one can be the director of the parking lot or be a CEO. During someone's career, it is not uncommon to be frequently tested to see where ones strengths and weaknesses lie. Also, failures do not result in firing, but employees who make mistakes in certain areas are supported and sometimes put on courses to educate them in order to improve their abilities.

Factor conditions

This determinant is hard to apply to education in Japan. The influence of factors like infrastructure and interest rates are hard to measure and are generally quite static in higher education. This is why the social and cultural factors of the structure of higher education are examined with greater care in this paragraph.

The prestige factor

As mentioned before, the prestige factor is more important than the quality of education in Japan. At the top of the hierarchy old imperial universities such as Tokyo and Kyoto are found. These are closely followed by a select group of private institutions that also have good reputations. Other public and private universities follow. The academic demands are generally lower than those of the public institutions. Also, private schools tend to be overcrowded and understaffed. There are 26 students per professor on average in the private division, compared with 8 per professor in the public schools.

Since the economic slowdown in the 1990s, delays in hiring occur. Nevertheless, students who graduate at institutions with high reputations are mostly assured of good jobs. While ability and performance are increasingly important for finding good jobs, chances of getting an elite position in a government department or a large firm are larger if one graduated at a university with high reputation. For the graduates of less good institutions, job hunting can be a trying process involving long trips, more exams (which are normal for most jobs) and lengthy interviews.

Most universities have placement services which are generally effective in finding employment for their graduates. Also, certain companies and universities are linked in a way where money is donated to the schools and jobs are provided for the students. Sometimes these companies interfere in the institution's affairs. Employers look for more than intelligence and ability and are interested in compatible personnel.

Faculty

The salaries for faculty members are in the range of those of managers of middle sized companies. However, because of the high living cost in Japan, the living standards of professors are a bit low compared to those of western professors. Japanese faculty salaries have been declining in comparison to the average national income. Furthermore, there is little salary difference between professors with the same number of years of service and there is not much salary difference among academic fields.

On the other hand, the Japanese professor does not endure job stress that is common for the average 'salaryman'. They are no victims of karoshi or death from overwork, quite a serious issue among middle aged white collar workers. The professors are not required to do anything besides teaching their classes unless they desire promotion which requires demonstration of scholarship through publication. Publishing is facilitated by the fact that universities have their own journals which publish professors' work and this results in no competition or outside refereeing. Another way of publishing is by translating foreign work and to publish it. There is a lack of performance evaluation, although today the government is making efforts to do so. Research support does not need to resulting published work.

Because most universities consist of more than one campus, professors may spend considerable time travelling to give lectures. Other activities may involve textbook publishing, involvement in juku (cram schools), consulting and administrative work. In is not uncommon for professors to lecture at several universities.

The term 'professor' may be a bit confusing, since most Japanese professors do not have a doctorate. Some have completed the course work towards a PhD, but have not written a dissertation. A significant part of staff and faculty are recruited directly from other professional areas. Many professors have had full careers and find a second job at a university after retirement. Another tendency is to hire graduates of the institution they graduated at (sometimes as high as 80%) and this part of the staff often forms its own network. This makes it hard for outsiders to function fully. The graduates of the more prestigious institutions think it is somewhat beneath them to have to do with graduates of other universities with a less good reputation.

Comparison

In Japan, the Ministry of Education, Culture, Sports, Science and Technology has a rather huge budged, namely 6322 billion Yen (47 billion Euro). The way the budget is spent is shown in figure 6.28 [161]:

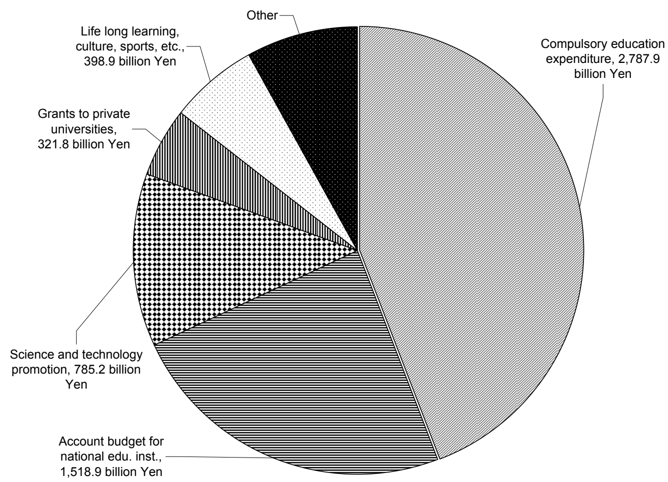


Figure 6.28: Japanese education expenditure.

The number of pupils per teacher in higher education in Japan is much lower than in the Netherlands, as can be seen in table 6.21.

Country	Pupil teacher ratio in tertiary education		
	1998/1999	1999/2000	2000/2001
China	14	...	18
Japan	8	8	8
The Netherlands	...	(est.)14	11
United States	...	13	13

Table 6.21: Pupil teacher ratio in tertiary education.

Japan only spends about 3.5% of its GNI on the whole educational system, but since its GNI was 4520 billion US Dollar in 2001 and the GNI of the Netherlands was 390 billion US Dollar, the difference seems rather large. However, when there is compensated for the larger population of Japan, the amount of money spent on education is about the same in both countries.

The Japanese system is still working towards equal education for all, though most institutions for higher education are private schools. The funding for these universities consists mostly of tuition fees. The national universities, on the other hand, are almost completely funded with government money. This system stands in high contrast with education in the Netherlands, where differentiation is just starting to occur and the funding of universities consists mainly of government money.

Country	Public expenditure on education as percentage of GNP (GNI)			Public expenditure on education as percentage of GDP			Public expenditure on education as percentage of total government exp.		
	98/99	99/00	00/01	98/99	99/00	00/01	89/99	99/00	00/01
China	2.2	...	...	2.2	...	...	13	...	...
Japan	3.4	3.5	3.5	3.5	3.5	3.5	...	9.3	10.5
The Netherlands	4.8	4.8	...	4.9	4.8	...	...	10.4	...
United States	5.0	5.0	4.9	5.0	5.1	4.8	...	...	15.5

Table 6.22: Expenditures on education.

Country	GDP spent on higher education (%)
The Netherlands	1.2
United States	1.1
Japan	0.5

Table 6.23: GDP spent on higher education.

Another difference is the budget spent on higher education compared to the gross domestic product (GDP). This ratio is quite high for the Netherlands, while for Japan this ratio is less than most first world countries (table 6.23).

Firm strategy, structure and rivalry

Since the way the educational system is built up in Japan is already treated in this report and the system in the Netherlands is supposed to be known, the main focus in this determinant will be on innovations found in higher education of Japan. This paragraph describes four innovations in higher eduction in Japan, begin: 'The University of the Air', 'The National Institute of Multimedia Education (NIME)', the role of international students and the tendency towards market-oriented thinking.

University of the Air

The University of the Air, which is quite an innovation, was established in 1983 for the purpose of promoting university education under a new educational system. It uses effectively television, radio and other various forms of media, offering opportunities for learning to a wide range of Japanese people. In January 1998 the University of the Air began broadcasting nationwide on satellite television (SKY PerfectTV!) and opened study centres throughout Japan. Since October 1998, therefore, the University has been accepting students from all over Japan who intend to work toward university degrees.

The university then began a course that serves to acquire the qualification of librarianship at a school library, and the refreshing education course. Also, the university deployed satellite spaces. As the standards for establishing a graduate school were revised in March 1998 and a correspondence graduate school was institutionalized, the university opened its graduate school in April 2001 and has been accepting students having applied for the master's course. The University of the Air has the following types of students:

- Faculty of Liberal Arts, Regular Student: A student who will graduate with a bachelor's degree (liberal arts). No entrance examination is required;
- One-Year Non-Degree Student: A student who desires to study the subject(s) of his/her choice. Enrollment is open to the people aged 15 years or older. The term of study is one year and no entrance examination is required;
- Graduate School, Regular Master's Course Student: A student who desires to complete the course, and will obtain a master's degree (arts) if he/she satisfies the completion requirements. Admission examination is conducted for enrolment;
- One-Semester Non-Degree Student: A student who desires to study the subject(s) of his/her choice. Enrollment is open to the people aged 18 years or older. The term of study is one semester (six months) and no entrance examination is required.

The National Institute of Multimedia Education

The National Institute of Multimedia Education (NIME), another innovation in higher education, functions as a core institution for promoting the use of multimedia. The institute conducts research and development on the content and methods for education that makes full use of diverse media and provides the results of such work.

At present, NIME is providing institutions of higher education and developing upper secondary education IT support programs, the research and development results listed below.

- Education network research and development system: research and development concerning the application of information communication technology, such as communication satellites and the internet, to education (Space Collaboration System);
- Research and development systems using media: research and development on the improvement of the content and methods of education by utilizing various media (Training of Mediause teaching methods);
- Learning resource research and development systems: research and development concerning the educational media materials that use the internet, DVD, etc., copyright processing systems and educational materials database, etc. (Media teaching-materials relation information Database, multimedia teaching materials).

Furthermore, as regards the educational use of multimedia, NIME is collaborating with other institutions of higher education in research and development and fulfilling its role of providing the results to the universities, colleges of technology and other academic institutions.

International students

International Exchange programs are very important for two reasons. First, because they enable a country to learn more about education in other countries and, in doing so, the Japanese government can improve its own educational system. Second, this can also be used to exchange technology between countries. The exchange programs also strengthen international relations with other countries.

Universities have always had an international character. Since the Meiji era the Japanese universities provided a role in modernizing Japanese society by means of studying Western civilization. In the nineteenth century ryugaku (study abroad) was introduced. In this system scholars, technicians and students went overseas to obtain knowledge in particular fields. The Japanese government was more interested in importing knowledge then exchanging it with other countries.

In 1983 plans where launched to accept 100,000 international students from abroad. After this accepting-policy, a gradual increase started in the number of international students in Japan. However, in 1995 the difference between Japan and other countries was still striking. In comparison, Japan reached the amount of international student that Britain had in the 1980s. Table 6.24 indicates that there where about 50,000 overseas students studying at post-secondary institutions in Japan. These students mostly came from Asian countries.

Country	Number of students
China	21.801
Korea	12.947
Taiwan	6207
Malaysia	3105
US	1192
Indonesia	1206
Other	5947
Total	52.405

Table 6.24: Overseas students in Japan in 1995.

Country	< 1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994
US	5	8	17	33	14	20
Britain	0	1	1	4	0	5
France	0	0	0	0	4	2
Germany	0	0	0	3	1	2
Canada	0	0	1	2	2	2
Russia	0	0	1	0	1	0
China	0	1	0	4	10	17
Korea	0	1	0	0	2	7
Australia	0	2	0	2	1	8
Other	0	0	0	1	6	3

Table 6.25: Number of countries participating in academic educational exchange.

In table 6.25, it is shown that the number of countries that is exchanging with Japan is slowly increasing until 1990. There are, however, still not enough counties that engage in these international exchange programs.

Nowadays the Japanese government is trying to promote these international exchange programs by emitting a scholarship for international exchange students. This scholarship is meant to:

- Facilitate financial aid to privately financed students;
- Promotion of mutual exchange between students;
- Enhancement of educational research instruction to foreign students.

To indicate the number of students that participate in these exchange programs, figure 6.29 is used. In this figure we can see the total foreign students that received financial aid from the Japanese government.

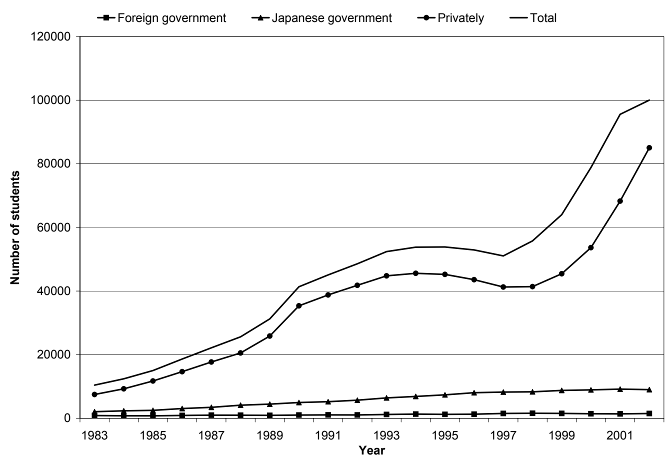


Figure 6.29: Number of government sponsored students.

In figure 6.29, it can be seen that the amount of privately financed students has rapidly risen since 1998 and also the Japanese student who went abroad has increased every year. The number of students studying abroad in 2000 was approximately 76,000 students in 32 countries. But the limit of 100,000 students still was untouched.

Tendency towards market-oriented thinking

It is quite clear that the rather large part of private institutions is a distinctive property of Japan. Consequently, the movement towards a market-oriented educational system is rather apparent, but in Japan it is not considered an innovation [172].

The national division kept its tuition fees low, which enabled it to gather the students with the best abilities. However, recently a policy of deregulation has been instituted which has lessened some of the protection of the national division. The result was an expansion of the private division to accommodate provision for mass higher education. The private division has responded to the market forces by lowering tuition fees and in addition the national division has introduced a sliding scale system. This decreases the difference between the two divisions in economical perspective.

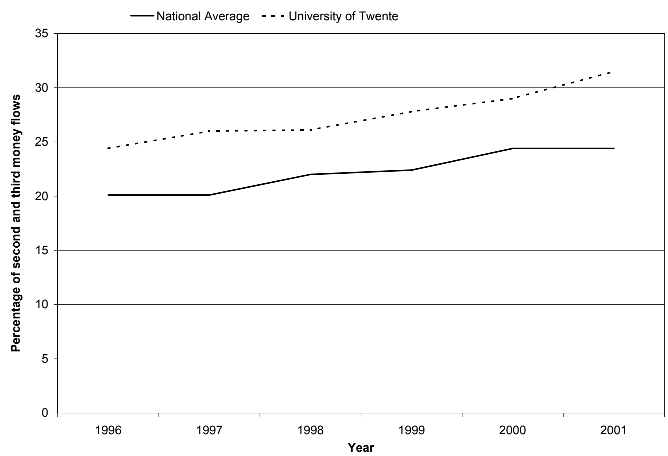


Figure 6.30: Percentage of second and third money flow in the Netherlands.

Figure 6.30 is an example of the change in which universities in the Netherlands are funded [173]. Our university is an example of a privatizing institute, since in 2001 about 30% of the total income of our university was funded in other ways than by government budget, the so called second and third money flow.

The private sector in Japan is mainly sustained by tuition fees, paid by the parents of the students or by part-time jobs. Another source of income for private institutions however, is interests and dividends of invested money. These funds are mostly governed by private school corporations. Recently, the interest has fallen due to economic downfall, which poses a problem for the private sector. A new way to generate income is the establishment of commercial activities by these corporations such as managing hotels, parking lots and renting buildings. Some private institutions, however, face bankruptcy.

Related and supporting industries

This paragraph is about the related and supporting industries and will the discuss some institutes that contribute in one way ore another to higher education in Japan and the Netherlands.

R&D at universities

Especially private institutions are market oriented, but most R&D is done outside universities. The trend to use universities for R&D suitable for marketable purposes is uncommon is Japan, while the opposite is standardized in the Netherlands. An institute like MESA$^+$ for example, which is directly coupled to our university, seems rather uncommon in Japan. R&D is done in institutions not linked with education, but rather with companies. In table 6.26, numbers of the United Kingdom are shown which give an indication of R&D in European countries. The United States are the top spenders on R&D.

Category	Indicator	Japan	US	UK
Input	Number of researchers (x 10,000 people)	72.8	111.4	15.9
	R&D expenditures (trillion Yen)	16.3	28.5	2.9
Degree of cooperation between industry and academia	Percentage of university research expenditure born by industry (%)	2.5	7.7	7.1
Output	Number of patent applications (x 10000)	79.2	220.6	40.0
	Number of scientific papers	74050	242216	68391
Achievements	Value of technology exports (x 100 million US Dollar)	102.3	380.3	62.3
	Export market shares for high-tech products (%)	13.2	25.5	8.7

Table 6.26: Comparison on R&D on different factors in different countries.

When a faculty receives budget allocations for R&D from the government, little feedback is given and results are not expected [172]. The government is trying to change this culture and bring more basic research in higher education, but because of the slow and rather huge organization of education this policy has no results at the moment.

The reason for this absence of R&D at universities is historical. After the Second World War, Japanese organizations introduced new technologies from western countries and commercialized them. R&D was mainly done by the companies. Nowadays, Japan tries to promote cooperation between the companies and universities. The technological institute of Tokyo University is a profound example.

The third-party evaluation institute

In the year 2000 a third-party evaluation institute was set up to evaluate both national and private universities [169]. This can be considered as an innovation, since before this time, universities only applied self-monitoring and self-evaluation, with some exceptions where some institutes evaluated each other. This new institute was a direct result of the government policy shift in a cultural sense, because before this time the autonomy of the universities was highly respected by the general public.

The institute evaluates three dimensions: education, research and social service. A second task is to make the results known to the general public which results in a new sense of accountability to the general public and taxpayers. In the future the allocation of funds could depend on this evaluation.

Government

The role of the government in higher education should be obvious by know, but some of its strategies concerning Japanese higher education will be discussed in this determinant. In social and economical sense, there is of course a demand on the government to provide education. This is the main motivation for government spending on education. Another demand on the government for good education is the need for skilled employees. In Japan the government itself and especially the bureaucratic community consists of a very high educated workforce.

The government ministry responsible for education in Japan is the Ministry of Education, Culture, Sports, Science and Technology (MEXT). Its policy has already been explained in division 73.

The Japanese way to determine the budget of an educational institute is quite different compared to the Netherlands [172]. First of all, the budget for the national and private sector is independent. For the national sector, it is determined by legal requirements. Budgets are calculated dependent on the number of faculty and students. Furthermore, the different professional chairs are weighed, such as clinical and experimental. All national universities have master courses, the main difference in budget allocation is dependent on whether doctoral courses or clinical courses are available.

The private institutions are assisted by Shiritugakko Shinko Joseihou (the private school assistance act) introduced in 1975. This amount of money, however, highly fluctuates, as in 1980 subsidy of ordinary expenditures peaked at 29.5% and declined to 12.4% in 1996.

It may seem that the self-control of higher education in Japan is high, but the opposite is true. The level of self government of universities in the Netherlands is the second highest (after Mexico) in the world according an OECD's survey [174]. Japan follows after most west European countries at the fourteenth place. The following eight factors were used to determine the self government:

- Own their buildings and equipment;
- Borrow funds;
- Spend budget to achieve their objectives;
- Set academic structure and course content;
- Employ and dismiss academic staff;
- Set salaries;
- Decide size of student enrollment;

- Decide level of tuition fees.

Our universities' funds are determined by the 'performance funded model'. Half of the total teaching budget in 2000 was determined by the number of degrees in 1999, 13% was determined by the number of first year enrolments. The remainder is fixed per university. Funding for research is funded in a different way. Funds for 'HBO' are dependent on programme characteristics, enrollment and completion rates. These two systems are rumored to be merged in 2005.

In Japan, the influence of the government is different for national and private institutions, but considered rather large. The administration and management of the national universities has a certain likeness with the European model, a strong faculty autonomy and a committee with some influence. Presidents of the institution are elected by the faculty members. Also, the Ministry of Education provides senior administrative officers to each national university, who manage the financial aspects.

The private sector has US-like characteristics, where a chairman and trustees of the private school corporation are responsible for administration and management and have considerable influence. The president, who is elected by the committee of the trustees, is responsible for the academic side. This difference between national and private institutions is a unique Japanese characteristic.

In 1991 the government issued a law to introduce the market principle including deregulation, competition, individualism and self-evaluation. This should result in a unique identity per university through self-study and evaluation [167]. Later on, the third-party institute was founded.

6.6.5 Comparison and conclusion

The comparisons of the other sections all show a table with the main differences between Japan and the Netherlands. Because the emphasis in this division has been on education in Japan and most determinants of Porter's Diamond have not been discussed for each country separately, this comparison will not show such a table.

There is an enormous difference in higher education between Japan and the Netherlands. Most universities in Japan are considered 'HBO' level with the exception of some national (Tokyo and Kyoto) and private institutions. The Junior Colleges are comparable with 'MBO' level. The absence of universities, as known in the Netherlands, makes the comparison between both countries hard.

In the Netherlands, the higher education is more involved in technical innovation compared to Japan. The Dutch students have to perform a lot af assignments at the universities and the trend is that a many assignments arise from companies. Most Japanese students start with the assignments once inside a company. The role of the Dutch universities in the innovation process is therefore more important than the role of the Japanese universities.

Since most universities in Japan are private institutions, a logical conclusion would be that the Japanese higher education is already market-oriented and flexible. However, this does not seem to be the case, as universities offer little more than an education to make the crossover to the labour market as easy as possible. Other types of income other than tuition fees and government funding are therefore hard to come by. The national universities were partly created to catch up with the advanced models that existed in other countries apart of the objective to create an elite workforce. The trend towards massification and globalization, however, makes this old system obsolete. The national universities have to shift their focus from high standards and status towards competitiveness and market oriented thinking if they want to survive the economy of today.

A fact is that it is not interesting for European students to study in Japan because the higher educational system in Japan is on a lower level. It may be interesting in a cultural sense but the educational value would not be as high as in western countries. The reason for this is a cultural one: Companies educate their new employees themselves. This interlinks with 'life long learning' and working for the same company ones whole life.

6.7 Conclusion

by Martin Schepers

This chapter has described the meso analysis carried out as part of the research project. The meso-level question that had to be answered by means of the research project for each division was:

> *Which fields of Electrical Engineering are of interest in the division and what are hot innovation topics in that division?*

The analysis has been done for different divisions of industry and has been based on Porter's Diamond. This conclusion first shows the different division that have been analyzed again for completeness. After that the results of the analysis on the different divisions is shown and the section is finalized with a preliminary conclusion.

6.7.1 Division definitions

As mentioned above, first the different divisions of interest will be shown. The division classification system ISIC Rev.3.1 has been used and some divisions have been chosen which contain important and interesting (electrical-) technological innovations on the field of Electrical Engineering. The selected divisions and underlying classes are shown below:

- From division 31 "Manufacture of electrical machinery and apparatus n.e.c" class:
  3110 - Manufacture of electric motors, generators and transformers;
  3120 - Manufacture of electricity distribution and control apparatus.
- From division 32 "Manufacture of radio, television and communication equipment and apparatus" class:
  3210 - Manufacture of electronic valves and tubes and other electronic components;
  3220 - Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy;
  3230 - Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods.
- From division 33 "Manufacture of medical, precision and optical instruments, watches and clocks" class:
  3311 - Manufacture of medical and surgical equipment and orthopaedic appliances;
  3312 - Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment;
  3313 - Manufacture of industrial process control equipment.

- From division 73 "Research and development", class:
  7310 - Research and experimental development on natural sciences and engineering (NSE).
- From division 80 "Education" class:
  8030 - Higher education.

6.7.2 Results of the analysis

This paragraph mentions the most important facts, as a result of the analysis of the different divisions with Porter's Diamond. It starts with innovation, followed by R&D and it ends with education.

Innovation

The Netherlands and Japan both want to be at the front of world leading innovative nations. For both countries, the research facilities are of high quality, but in Japan the quantity is better. The governments and companies believe that innovations are a strong and long term solution to make the economy healthier. In order to achieve these innovations, a government sometimes has to make some offers. While the primary goal of the governments usually is 'to improve the economy', this sometimes has to go along with deregulation and spending more on research.

It seems that Japan, as a whole, thinks and knows investments in innovation are important. The investments and expenses in high technology research in Japan are growing for years. Over the years, Japan has acquired a position as an international competitive nation and it seems it can maintain this position. The work done on this is of high level and investments and spirit give some guarantees for the future.

In the Netherlands, companies and government create the idea that they are very careful to invest in innovation. The investments and expenses in high technology research in the Netherlands are stable or decreasing. Although investments in basic research are still higher than much other countries and the cooperation between public and private divisions is strong, the Netherlands have to fear for their position. The Netherlands were always at the front of innovation but seem to slide away further and further. In order to keep up with Japan, big efforts have to be made in the future by the Netherlands.

There are quite a few barriers, that can make it very hard for a company to succeed in Japan or the Netherlands. Fighting your way through regulations takes an incredible amount of work if you want to settle in one of these countries. In the past however, it used to be much worse in Japan. The companies, however, still try to settle and develop new products. The motivation comes from the fact that with a revolutionary idea, any small company could conquer the market.

Inside the companies, there also is a big difference. In Japan, people tend to work longer, but the Dutch workers seem to work more effective. In the Netherlands, people at companies tend to confer more in order to be more effective. Furthermore, the productivity in the Netherlands is a little lower than in Japan. The cause of this might be that Dutch workers are expensive workers. The situation in Japan is, in this respect, a bit more favourable.

Research and Development

Both countries deliver R&D of a high quality. There is however a difference between both countries. The Netherlands commits research of a higher quality, whereas Japan develops more products as a result of the research. In other words: The basics in the Netherlands are better, but in Japan products are developed and that is in the end what innovation is about!

Although Japan does have a good R&D system, not much R&D is done at universities. The trend to use universities for R&D suitable for marketable purposes is uncommon is Japan, while the opposite is standardized in the Netherlands. R&D is done in institutions not linked with education, but rather with companies.

In recent years the trend has been that the Netherlands request much more patents compared to Japan. Some people claim this is changing and that Japan is nowadays on the same technological level as the EU and the US. A reason for this catch up, is that the government of Japan stimulates R&D. An example is the establishment of the Japanese Patent Office (JPO), which aims at a smooth development of patent requests.

Education

On education, there is also something that has to be said. In general, the level of education in the Netherlands is higher compared to Japan. The Japanese universities are at the same level as the Dutch ‘HBO’. It is therefore not very interesting for European students to study in Japan. It may be interesting in a cultural sense but the educational value would not be as high as in western countries. The reason for this is a cultural one: Companies in Japan educate their new employees themselves. This interlinks with ‘life long learning’ and working for the same company ones whole life.

Furthermore, in the Netherlands, the higher education is more involved in technical innovation compared to Japan. The Dutch students have to perform a lot af assignments at the universities and the trend is that a many assignments arise from companies. Most Japanese students start with the assignments once inside a company. The role of the Dutch universities in the innovation process is therefore more important than the role of the Japanese universities.

Since most universities in Japan are private institutions, a logical conclusion would be that the Japanese higher education is already market-oriented and flexible. However, this does not seem to be the case, as universities offer little more than an education to make the crossover to the labour market as easy as possible. Other types of income other than tuition fees and government funding are therefore hard to come by. The national universities were partly created to catch up with the advanced models that existed in other countries apart of the objective to create an elite workforce. The trend towards massification and globalization, however, makes this old system obsolete. The national universities have to shift their focus from high standards and status towards competitiveness and market oriented thinking if they want to survive the economy of today.

Chapter 7

Preliminary conclusion

In the previous three chapters is tried to find factors that influence technical innovation in Japan and the Netherlands according to the main research question:

> *What are the key factors that influence technical innovation in Japan and the Netherlands?*

The concept of technical innovation was investigated as well as the macro and meso-economic environment, in order to find such factors. The result of this search allows a depiction of the environment in which companies, universities and institutes exist. In the sequel of the project, a selection of these companies, universities and institutes will be visited. Then will be searched for factors that influence innovation on the micro-economic level. This report is preliminary to the visits, and the conclusions that are drawn here are only temporary conclusions of the project.

In section 5.11 and section 6.7 conclusions on the macro- and meso economic level respectively have been drawn. In section 4.8, we have drawn conclusions on the concept of technical innovation. However, until now we have not drawn conclusions that interlink these levels. We will do this in this chapter.

Culture has a big influence on innovation. Relevant cultural aspects are:

- The enthusiasm to grasp opportunities. Regarding this it can be said that the Japanese strongly believe they are better. This creates a culture that makes the Japanese implement the best of others and that enhances their ability to improve them. The productivity of Japanese employees is a little higher than that of Dutch employees. Although Dutch employees are a little more effective, they cannot compensate for the working time of Japanese. This difference is getting larger in favour of the Japanese;

- The level of appropriation of technology developments. In our research, it appeared that Japanese people show a great curiosity to new ideas. Japanese consumers are early adopters of innovations while the Dutch belong to the early majority;
- The quality of communication lines between persons over which technology is transferred. In Japanese enterprises, a strong formal as well as informal structure go hand-in-hand. In the Netherlands, there is no such two-way communication line. The Dutch formal structure becomes more informal by time.

The ability to sell products that stimulate innovation is a major economic factor that influences innovation. Different sectors of industry recognise that in Japan more products are developed and that the development of products is what innovation is about. Japan has increased the number of international markets it accesses, but nevertheless the Dutch serve more markets. However, the export rates of technological intensive products are equal, so probably the quantity of exported Japanese products to certain foreign markets is larger. The national market of Japan is larger, of course, but the Dutch participate in the European internal market which offers them good opportunities. The ability to sell products that stimulate innovation is not only dependent on the size of the markets but also sensitive to the economical climate. In a stagnating economy, investments are postponed and consumers are precautious with spending their money. Japan has had a stagnating economy for the past ten years, while the Dutch economy is stagnating only since a few years ago.

Also the ability to gain knowledge on international markets is an important factor. There are less foreign investors in Japan than in the Netherlands, so less foreign knowledge is brought to Japan. Knowledge transfer between national institutions is higher in the Netherlands than in Japan, since in Japan employees have a life-long commitment to one single company while Dutch employees do switch between employers.

Main political factors that influence innovation, influence the scale of the output markets, both national and international. A main objective of the Japanese government is to create and sustain a healthy economic market. Apart from the election system, governments can be considered equal, however, active policies are not. In both countries R&D policies become more focussed on competitive support of public universities and institutes to the private sector, for the purpose of making money with innovative products. The Japanese public institutions seem lagging in this aspect. The Dutch higher education is more involved in the innovation process than the Japanese. Japanese companies, private institutions, educate their employees themselves, while public institutions only try to make the crossover to labour market as easy as possible.

Regional stability is another political factor that influences innovation. Japan has been dependent on the United States for security and economy, but becomes more and more independent. For resources Japan has become less dependent on

Western powers.

Regulations on environmental policy are inhibiting innovation. The Dutch are more active on this than the Japanese. However, for instance the process of getting approval for using medical equipment is more complicated in Japan than in the Netherlands. These and other regulations let institutions encounter a lot of paperwork. Regulations also contribute to the fact that Japan is more difficult to access and settle for foreign companies than the Netherlands.

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PART II

OTHER ACTIVITIES

Chapter 8

Study tour

On the 1st of November 2004, the airplane with the Shouraizou participants aboard will lift off from Schiphol Airport. With this event, the journey part of the study project starts and the participants are leaving for 3 weeks of technology, culture and innovation in Japan.

8.1 Schedule

The travel schedule is filled with technological excursions. Two of the "world's bests" will be visited. SPring-8, the world's largest third generation synchrotron facility; and The Earth Simulator Center, the world's most powerful computer. At Sony's Media World, we will have an extra long demonstration of QRIO, Sony's humanoid which is able to walk and dance.

At the university of Sendai a meeting with Japanese students is planned; the Shouraizou participants and the Japanese students will compete each other in small mixed groups in solving a small problem. This way, cultural differences and different solving strategies between the Japanese and Dutch will be experienced.

For Dutch people, the first experience in Japan will be a complete culture shock. The day after our arrival in Japan is a national holiday called *bunka no hi*; "Culture day". According to the Meteorological Agency of Japan, this day is one of the days with the highest probability of fine weather. What a perfect day for the kick off of the Shouraizou study tour through Japan! The tour will start in Osaka. Among Osaka's highlights are the Kaiyukan Aquarium, one of the world's largest aquariums and famous for its whale shark, and the *doutombori* area, where *"a peculiar type of Darwinism is the rule for both people and shops: survival of the flashiest"*, according to Lonely Planet's travel guide to Japan. Himeji Castle will be visited, which is one of the very few Japanese castles still standing in its original form and is considered Japan's most beautiful castle.

On August 6, 1945, the Allied forces dropped two atomic bombs, one on Hiroshima and one on Nagasaki. To assure such an event will never happen again, Hiroshima has been engaged in the promotion of peace ever since. We will visit Hiroshima to commemorate the drop of the atomic bomb.

On Wednesday 24th November, after three weeks of innovation, culture and fun in Japan, the study tour will end in Tokyo. The participants will fly home, some immediately, some after a couple of more days in Japan. Perhaps for some, the return to the Netherlands will only be temporarily. The return to the Netherlands is only needed to plan the next visit to Japan . . .

		City	Activity
Mon 01-Nov		Amsterdam (NL)	Departure from Schiphol Airport to Japan
Tue 02-Nov		Osaka	Arrival at Osaka Itami Airport
Wed 03-Nov	AM	Osaka	National holiday
	PM		Culture
Thu 04-Nov	AM	Shiga	Ritsumeikan University
	PM	Kyoto	Horiba Ltd.
Fri 05-Nov	AM	Aioi	SPring-8
	PM	Himeji	Himeji Castle
Sat 06-Nov		Hiroshima	A-bomb dome, peace park
Sun 07-Nov		Kyoto	Sight-seeing
Mon 08-Nov	AM	Osaka	Matsushita R&D
	PM	Osaka	Osaka University
Tue 09-Nov	AM	Osaka	Mitsubishi R&D
	PM	Nara	Shigi-san Temple
Wed 10-Nov			Travel to Tokyo by Shinkansen
Thu 11-Nov	AM	Yokohama	Hitachi PERL
	PM	Kawasaki	Toshiba
Fri 12-Nov	AM	Tokyo	Tsukiji fish market & Honda
	PM	Tokyo	Tokyo University
Sat 13-Nov		Tokyo	Day off
Sun 14-Nov			Sight seeing
Mon 15-Nov	AM	Atsugi	NTT Labs
	PM	Atsugi	Showa Shell
Tue 16-Nov	AM	Atsugi	AKM
	PM		Culture
Wed 17-Nov	AM	Tokyo	The Earth Simulation Center
	PM	Tokyo	SONY Media world
Thu 18-Nov			Travel to Sendai by Shinkansen
Fri 19-Nov		Sendai	Tohoku University campus
Sat 20-Nov		Sendai	
Sun 21-Nov			Travel to Akita by Shinkansen
Mon 22-Nov	AM	Akita	Akita University
	PM	Akita	Akita Institute of Technology
Tue 23-Nov			Travel to Tokyo by Shinansen
Wed 24-Nov		Tokyo	Departure from Narita to the Netherlands

Figure 8.1: Map of Japan with the travel scheme.

Chapter 9

Contract research assignments

9.1 Introduction

As part of the study project every participant worked on a so called contract research assignment. A contract research assignment is a project to be fulfilled by a student participant for a third party in a fixed amount of time, being 120 hours for every participant. For the contract research assignments Shouraizou defined the following goal:

A student participant will work on a contract research in order to earn money for the study project making the study tour affordable for the student participants. Also a student participant will gain new knowledge, get some relevant work experience and get in contact with a possible future employer.

Now, looking back, it can be concluded that Shouraizou succeeded in reaching their goals for the contract research assignments. Shouraizou raised enough money to organize an affordable study tour to Japan and every student participant has been provided with a challenging assignment. Our principals together with the project assignments and the persons who worked on the assignments are presented in this chapter. The outcomes and experiences of the participants will be presented in the final report.

9.2 Project descriptions

Principal: **Systems and Materials for Information Storage (SMI)**
University of Twente

University of Twente
The Netherlands

Profile: The research activities of SMI concentrate on materials, devices and systems for information storage. At present, the emphasis is on magnetic data storage.

`http://www.el.utwente.nl/smi/`

Project: **OpenReference**

SMI had started development of a webbased system called OpenReference. It is a system to manage large quantities of reports, papers and references and provides a common interface and centralised database for multiple co-workers. Currently there is a running version but it still lacks features and isn't ready to be used yet. Goal of the project is to finish it and make it ready for production use. See also: `https://sourceforge.net/project/oref/`

Student: Eelco Dalhuisen

Project: **Anomalous Hall Effect**

The goals of this contract research are: design a sample holder, change and improve the Anomalous Hall Effect measurement setup and measure magnetic properties of different Co/Pt multilayer dots.

Student: Mathijs Marsman

THALES

Principal: **Thales**

Profile: Thales Nederland plays a leading role when it comes to supporting the operational missions of the world navies and armies. Sophisticated technology based on 80 years of experience allows us to provide the full spectrum of solutions.

`http://www.thales-nederland.nl`

Project: **Active Phased Array Antenna Unit**

This project is classified.

Students: Bart Spikker
Thomas Janson

University of Twente
The Netherlands

Principal: **Measurement and Instrumentation (MI)**
University of Twente

Profile: The Laboratory for Measurement and Instrumentation provides an educational program in measurement at an academic level, studies the Science of Metrology and brings knowledge into practice, whereas the research activities concentrate on signal acquisition and signal processing.

`http://www.mi.utwente.nl`

Project: **Development of a State Predictor**

The goal of this research is to develop and to evaluate a method for the prediction of future states of a dynamic system using measurements of these states. The predictions must be done under different circumstances. The method will be based on optimal estimation theory and will be tested using real measurement data.

Student: Michel Franken

versatel

Principal: **Versatel**

Profile: Versatel is an ambitious telecommunications company on the Dutch, Belgian and German market. The company has an extensive product portfolio of fixed telephony, data, internet and recently mobile telephony products.

http://www.versatel.com

Project: **MDF**

To guarantee the continuity of the telecom services provided by Versatel, the conditions of the Local Exchange boxes have to be monitored. We will write a report on how to implement a system that would perform functions such as monitoring the status of the auxiliary power supply and environmental temperature.

Students: Casper van Benthem
Janarthanan Sundaram

Project: **ESD**

The reliability of electronic systems depends on a few factors. ElectroStatic Discharge (ESD) is one of those factors. The goal of this project is to write a consultancy report about how ESD prevention in Versatel's electronic systems can be lifted to a higher level to reduce ESD to a further minimum.

Students: Bertjan Davelaar
Laurens van Oostveen

Project: **CBDB**

A major node in the Versatel network is called a PoP (Point of Prescence). Here big glassfiber cables are multiplexed in different lines with smaller bandwith. For the sake of redundancy, the multiplexers have 2 supply lines. In principle, if one of the power lines would fail, the other one would take over. Some implementations of this principle are not entirely spotless. At a few locations, it is the case that if the redundant power line would fail, the operator sometimes wouldn't get an alarm. Goal of the assignment is to accurately determine why this is sometimes happening at some PoP's, and to suggest a solution.

Student: Paul Omta

University of Twente
The Netherlands

Principal: **Integrated Circuit Design (ICD)**
University of Twente

Profile: The main subject of the education and research programs of ICD is the design of integrated circuits, with a focus on CMOS Transceivers. Due to many contacts and research contracts with industry, and the part-time position of some staff members in industry, the industrial relevance of the research program and the knowledge transfer is high.

`http://www.icd.el.utwente.nl`

Project: **Individual Research Assignment**

In a phantom oscillator architecture, multiple mixers are used to design a system that behaves like one single mixer, but with improvements in DC offset, IIP2 (second order) noise and LO (local oscillator) radiation. In the assignment the technology behind the phantom oscillator has to be researched. Practically a-periodic signals have to be used to demonstrate the principle. Also the advantages in DC offset, IIP2-noise and LO-radiation have to be demonstrated.

Student: Harald Profijt

Project: **Laboratory Assignment**

No description available yet.

Student: Jos Ansink

Principal: **Royal Netherlands Naval College (KIM)**

Profile: At the Royal Netherlands Naval College, young people having made their choice to work and study at the army, are trained for the profession of officer at the Royal Dutch Navy.

`http://www.kim.nl`

Project: **XML**

The goal of this project is to create a dynamically built HTML interface from one or more XML files. The XML files contain the information of the next years curriculum. The HTML interface should provide an overview of the curriculum and a mechanism in which users can enter queries to select courses in the XML files. The result of the query should be shown in a graphical way and containing links to the detailed pages of the courses.

Student: Maarten Bezemer

Project: **Signal Processing**

No description available yet.

Student: Kasper van Zon

Principal: **Capital Turbines MC&R**

Profile: Capital Turbines was formed in the year 2000, with a target to become a world class energy service provider, in that short time Capital Turbines has grown rapidly and now has offices in 6 countries, Australia, Chile, The Netherlands, Indonesia, New Zealand and USA, with ever increasing resource base.

`http://www.capitalturbines.com`

Project: **Coal Gasification**

Investigate what the possibilities are of the coal gasification process and if it is usable for gas turbines. Coal gasification is a process that converts carbonaceous feedstock into gaseous products at high temperature. The resulting product is a synthesis gas which is a mixture of predominantly CO and H2. This gas can be used in gas turbines and provide electricity where needed.

Student: Sebastiaan van Loon

Principal: **Strukton Railinfra**

Profile: Strukton Railinfra B.V. is part of the Strukton Group N.V.. Strukton Railinfra is one of the big innovative railinfrastructure specialists in Europe being able to offer an complete package for both rail and other mobility system. Strukton Systems' expertise is used for projects on among others energy supply, infrastructure and (travellers) information systems, sign systems and electrotechnical systems in rolling material.

`http://www.struktonrailinfra.com`

Project: **POSS**

Strukton Systems focuses on railway mobility systems and is the developer of the preventive maintenance and failure diagnostics system POSS. One of the features of the POSS system is to predict and detect railway switch failures. The Contract Research aims to improve this system. More information is available at `www.possinfo.com`.

Students: Jasper Klewer
Dirk van Schaijk

Principal: **Schröder Auto-Totaal**

Profile: Schröder Auto-Totaal is a car company specialised in car maintenance, electrical installations, air-conditioning system and brake service.

`http://www.schroderautototaal.nl/`

Project: **Designing and building a prototype**

A prototype has to be made of a small device that is capable of doing a few specific tasks. The power needed to operate will only be supplied by solar power. In order to assure the secrecy no specific details about the functionality will be presented here. The project will probably be a mixture of a micro-controller/micro-computer with additional digital hardware including diverse analog circuits to provide the required functionality. Because the lack of a strong power supply the design also has to be very energy-efficient.

Student: Pieter Cuperus

Principal:	**Texas Instruments** The Netherlands, Almelo
Profile:	The Sensors and Controls Business Center in Almelo is responsible for controls and sensors for Europe's automotive and appliance industries. The site also houses activity for the Texas Instruments Radio Frequency Identification System business. `http://www.ti.com/europe/docs/sites/holland.htm`
Project:	**HVAC** This research project is carried out at Texas Instruments Almelo, in the design engineering department of automotive sensors. An air quality sensor that senses harmful gasses in the outside air is currently under development. The signal of this sensor is used for automatic control of the recirculation valve in an air conditioning system of a car. The main goal of this research is to model the heat flow and temperature distribution in the sensor.
Student:	Martin Schepers

Principal: **Océ Technologies**

Profile: Océ is one of the world's leading companies in the area of document and information management. In advanced research centers and high-tech production facilities the company develops products and services for the efficient and effective exchange of information. These comprise products for the reproduction, presentation, distribution and management of documents. The range of products and services offered by Océ is characterized by its recognized high quality, which is based on reliability, productivity, durability, ease of use and environmental friendliness.

http://www.oce.com

Project: **Paper sensor**

The assignment deals with a new paper-sensor concept. An important goal is to create a cheaper sensor. Another characteristic of the concept is the expected increase in accuracy and reliability. The assignment is to analyze and to test the new concept, to develop a theoretical model, to discover the capabilities of the concept, and to improve it (if possible).

Student: Niek Bouman

Project: **Half toning algorithm**

The objective of this assignment is to explore a new algorithm for half toning and to propose a mapping for this algorithm on a given platform. A part of this assignment is to determine the quality of the output of the algorithm for both western and Japanese characters.

Student: Joost de Klepper

Principal: **Philips Centre for Industrial Technologies (CFT)**

PHILIPS

Profile: Philips' Centre for Industrial Technology (CFT) is the dedicated center for technology implementation, a partner for Philips and selected external customers. There is only 'one' Philips; and in there Philips CFT is the competence center able to translate new technology into tangible, afforable products, processes and industrial set up quickly and reliable. CFT incorporates the results of Philips' fundamental research, market insights and plans from technology and product roadmaps.

`http://www.cft.philips.com`

Project: **Literature study on Micro-mechatronics**

The goal of this research assignment is to explore ongoing activities in the field of micro-mechatronics. The main part of this research will concentrate on the current activities at the MESA+ research institute. The result of the assignment will be a report that gives an overview of the achievements in the field of micro-mechatronics.

Student: Michel van Dijk

Principal: **Philips Research**

PHILIPS

Profile: In close cooperation with the Philips Product Divisions, the Philips Research organization generates options for new and improved products and processes and produces important patents in many fields. These patents are important, because they protect technological achievements and enable Philips to gain access to the knowledge of others. Philips Research also provides a window on the outside scientific and technological world.

`http://www.research.philips.com`

Project: **Design temperature sensor using nano-technology**

No description available yet.

Students: Frank van der Aa
Rogier Veenhuis

Principal: **MESA$^+$ Research Institute**

Profile: MESA$^+$ is the largest research institute of the University of Twente. The institute trains graduate students and PhD-students and conducts research in the fields of nanotechnology, microsystems, materials science and microelectronics.

`http://www.mesaplus.utwente.nl`

Project: **Management Assistant**

No description available yet.

Students: Lodewijk Bouwman

Principal: **Spark Design Engineering**

Profile: Spark Design Engineering is an independent and professional engineering consultancy that conceives, designs and produces industrial and consumer products. Spark has an experienced, specialised staff. Engineers with a flair for design and designers with a feel for engineering - Spark can bring ideas to life. It develops products through a symbiosis of technology, form and function.

`http://www.sparkdesign.nl/`

Project: **Lighting System**

The objective of this research is the design of a tuneable power supply which will be applied in a special kind of light source. The power supply will generate a very high frequency high voltage, while the input is a low voltage DC source. It will be a challenge to design this power supply and pay also attention to different aspects like radiation and short circuit and open circuit securities.

Students: Matthijs Krens
Casper Smit

Chapter 10

Cultural activities

10.1 Introduction

No matter how much one reads in travel guides, magazines or newspapers, there is only one way to really get to know a country like Japan: step on a plane and visit it! That does not mean though, that preparations before a tour are not useful. It is our vision that we can only get to know Japan during the study tour, if we are well prepared on the language, the social aspects of life in Japan and the culture. Therefore there were several cultural preparations organized for the participants by the Shouraizou committee. Furthermore, every participant will be handed out a travel guide with a lot of practical information for the study tour and he was encouraged to read more about Japan himself.

In this chapter the Japanese language course that was organized specially for the project is described. This is followed by a report of two events: a film night and a Japanese dinner.

10.2 Language course

Language is one of the key factors in bridging the gap between cultures. The participants of Shouraizou recognized this and almost all participants followed a Japanese language course, which had been organized by the Shouraizou committee, in cooperation with Marcel van den Elst, the International Office at the University of Twente and dr. S.J. de Boer. Van den Elst, a former Electrical Engineering student at the University of Twente, has a very good knowledge of the Japanese language and is a frequent visitor of Japan.

There is a Japanese proverb that says: "If you wish to learn the highest truths, begin with the alphabet." This certainly goes for the Japanese language, since the Japanese writing is composed of two syllabic scripts, called hiragana and katakana, and thousands of Chinese characacters, called Kanji. A Japanese text typically consists of a mixture of Kanji and kana, with the latter normally outnumbering the former. Kanji are used to write words of Chinese origin and native Japanese words, whereas hiragana is used to write grammatical elements and katakana is used to write Western loanwords and names. The language course started with learning hiragana and katakana and troughout the course we mainly focused on these syllabary, although we also made use of romaji, the Roman alphabet that Western countries use, and learned some Kanji.

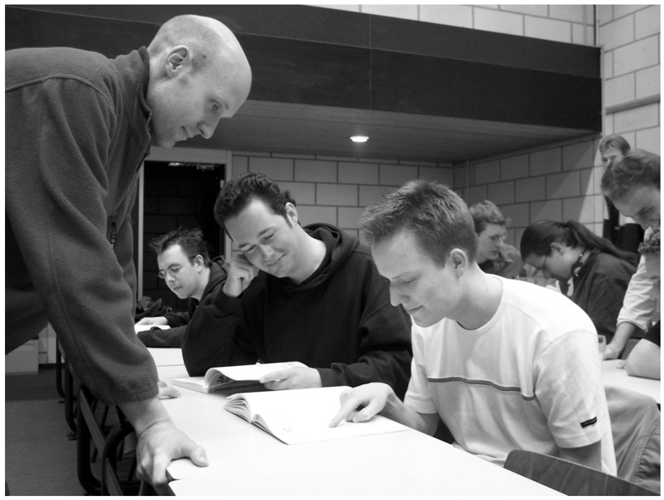

Figure 10.1: Johan and Arjen get additional explanation from Marcel van den Elst.

The language course mainly focused on the use of Japanese in everyday-life. During the lectures, which were given by Marcel van den Elst, we learned to introduce ourselves and others, the use of date and time for meeting and travelling, understanding of prices and the Japanese way of counting, describing things and people, asking and understanding questions, some plain social talk and many more. Apart from the lectures, in which students mainly spoke Japanese and interacted with each other in real-life situations, doing homework and increasing the vocabulary was a crucial part of the course. Furthermore, background information on Japan and personal experiences from Marcel van den Elst were provided throughout the whole course.

At the end of the course, students took a test in which not only their knowledge of vocabulary and grammar was tested, which also tested their ability to understand spoken Japanese. Although the participants do not speak Japanese fluently at the moment, they have gained enough knowledge of the Japanese language to have simple conversations. What may be even more important is that by having learned the basics of the language, they are now able to continue the language study by themselves.

10.3 Film night

The film night was organized in cooperation with Concordia, a centre for art and culture in Enschede. Goal of this event was to make the participants aware of the huge differences between the ancient and the contemporary Japan. Two Japanese movies were shown in the small theater, namely 'Bright Future' (Tasogare Seibei) and 'Twilight Samurai' (Akarui Mirai).

Twilight Samurai tells the story Seibei Iguchi, a low-ranking samurai, who leads a life without glory as a bureaucrat in the mid-XIX century Japan. He is a widower, and he has charge of two daughters (whom he adores) and a senile mother; he must therefore work in the fields and accept piecework to make ends meet. New prospects seem to open up when Tomoe, his long-time love, divorces a brutal husband. However, even as the Japanese feudal system is unraveling, Seibei remains bound by the code of honor of the samurai and by his own sense of social precedences. The participants enjoyed the beautiful pictures and appealing plot of this movie very much.

The second movie, Bright Future, dealt with the two friends Mamoru and Yuji, aimless young men stuck in dead-end jobs in a dreary factory in Tokyo. Mamoru, the more antisocial of the two, is obsessed with his pet project of acclimating a poisonous jellyfish to fresh water by gradually changing the water in its tank. One night, he inexplicably murders his boss' family and is sentenced to death. Yuji, left to continue the jellyfish experiment, befriends Mamoru's estranged father, and the two form a bond that helps him overcome his emotional troubles. But his attachment to the jellyfish is even stronger, and problems arise when he accidentally releases the poisonous creature into the canals of Tokyo. The plot and the story behind this movie were a bit more difficult to understand and most people seemed to like it less than the other movie.

Although the interpretation of movies is something personal and it's hard to tell if people really learned something from watching them, it can generally be said that participants were shown two very different pictures of the country they are going to visit.

10.4 Japanese dinner

When the words 'Japan' and 'dinner' are mentioned in one sentence, many people will immediately think of chopsticks. And indeed, chopsticks are the most frequently used kitchen utensils in Japan. But the utensils are not the most interesting part of the Japanese kitchen, of course. Who hasn't heard of sushi (vinegared rice combined with other ingredients), sashimi (raw seafood), teriyaki (grilled beef in sweet marinade) or sake (rice wine)? To give participants a first taste of the Japanese kitchen and to learn them how to eat with chopsticks, a Japanese dinner at the local Japanese restaurant 'Kimono' was organized.

As a preparation, participants were handed out a newsletter on how to use their chopsticks. During dinner, it turned out that this was not a bad idea: many students had practiced for example with pencils and peanuts, and they were able to finish their dinner without knife and fork. Everybody enjoyed the tricks with eggs, knifes and spices by the cooks and of course the delicious food.

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Where can I find ... ?