



Manufacturing as part of a vital enterprise structure

Global industrial trends, the state of Finland's
manufacturing industry and the steps for
reforming Finnish manufacturing industry

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This report examines the prerequisites for growth-oriented renewal in Finland's industry and the means available to the public authorities to promote renewal. In the first part of the report, trends for change affecting the global manufacturing industry are examined. In particular, attention is paid to the impacts on the formation of gross national product in the national economy caused by global value chains in terms of their development towards splintering into smaller parts. The export of goods has an important role, but export operations are no longer the only channel linked with international exchange. Value is being channelled towards the national economy in the global networking economy along other routes as well. In the second section, Finland's industrial situation is examined. The waning of industrial value added is the most significant of our various challenges at this time. The decline in the number of industrial jobs is also not a trouble-free aspect, but nevertheless better in line with the advancement seen in other developing countries. In the third section, points of departure in the growth-oriented renewal of Finnish industry are sought. Finland's strengths are conversely based on natural resources in industry that is resource-intensive, but are found in particular in innovation-intensive industrial activity based on expertise. New possibilities will open if, through our expertise, we are able to obtain a better grip on the global challenges and related customer requirements. It is now more important than in the past for companies to manage the entire value chain, since manufacturing is only one link in the same. At the same time, industrial sustainability should be augmented with regard to the national economy of Finland so that new industrial enterprises capable of international operations will rise within our midst. As the interests of businesses and the national economy differ, it is important to ensure that Finland obtains its share as a national economy of the processing value thereby generated. The public authorities must particularly give attention to the general requirements of competitiveness. They may, however, also be involved on their part in supporting the growth-oriented renewal of industry, especially by means of innovation policies. Also through the development of financial markets, export and the promotion of internationalisation, etc., it is possible to support the renewal of industry. The State can also challenge commercial life to a dialogue on the direction and prerequisites for industrial growth and regeneration.			
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Preface

The manufacturing industry has formed the backbone of Finland's economy. We transitioned from an agrarian society to an industrial one in stages. The forests were the natural growing platform for our manufacturing industry, and the forestry industry has also helped other industries form in Finland. Like our economy, our manufacturing industry has also had to reform many times after its initial stages.

Manufacturing industry and exports have gone hand in hand. Seeing a Made in Finland label on the marketplaces of the world has also boosted the national self-esteem. A common saying has been, "When exports are doing well, Finland is doing well."

However, the world changes, and we ourselves have benefited from this change. The traditional export of physical goods is no longer as important as it used to be. For example, when the Nokia cluster produced nine billion euros worth of value added for Finland in 2007—a quarter of the entire industrial value added—it was no longer fully about the traditional export of physical goods from Finland abroad. With mobile phones manufactured in China and sold in the U.S., a great part of the sales price was channelled into Finland. We had tapped into the global network economy.

For now, however, Finland's Nokia party is over. The industrial value added of Finland is three-quarters of what it was in 2007. The relationship between the manufacturing industry and services has gradually changed. Manufacturing is an important part of the value chain but building on it alone will no longer be enough to cope in today's world. The other parts of the value chains are also important. Similarly, it is increasingly difficult to separate industrial production from service production. New technologies affect industrial development. The market demand is transforming and becoming more scattered. We need reform once again, for many reasons.

Enterprises have created growth and, ultimately, been responsible for successful business activity. The state has had and continues to have interest in promoting successful business. The means of the government change along with the markets and the operating environments. Each time, one must think of the best practice available at that time.

Without access to market and free competition, Finland would never have attained the position it now has, as it would have remained in the shadow of the major players. For this reason, our premise is to continue promoting rule-based international free trade.

In order for it to be worthwhile for companies to invest in Finland, whether materially or immaterially, Finland must appear sufficiently attractive as an operating environment. Nourishing the attractiveness of Finland requires a way of

life that continuously improves the features of its competitiveness. Plenty of work remains in this field.

I have also said that Finland's strengths are *wood* and *intelligence*. Succeeding in free trade requires that we utilise our natural potential. The forest and other raw material base provide a good premise, but our current prosperity and redeeming the promises of welfare state increasingly require competence and the ability to innovate as well. Reforming challenges us all to seek new possibilities, ones we are not familiar with.

Freedom of enterprise means that everyone has the possibility to start a business and prosper. The state cannot and even should not choose the winners. However, as a nation, we can analyse market demand and anticipate changes in the demand. At the same time, we can assess our natural strengths and develop them. Although the tools of public government have changed, it still has many means for promoting economic and industrial success through various policy measures. Promoting and regulating education, innovation activities, export and internationalisation and other means help contribute to us getting making the most of our strengths. Therefore, the public government should strive, where possible, to not only build general prerequisites for competitiveness but also, to a certain extent, lead growth based on comprehensive analyses.

The report *Manufacturing as part of a vital enterprise structure* probes Finland's industrial possibilities and aims to take into account changes in global demand. It discusses what should happen in Finland in order for the manufacturing industry to be able to grow and renew. At the same time, it questions how the public government could participate in this renewal right now.

The emphasis of the report is on the renewal of the manufacturing industry, in microeconomy. Macroeconomy, i.e., a review of the general competitiveness of the operating environment, is included merely as a reference. The reason for this is that the earlier investigator reports commissioned by Jyrki Katainen's government have been implemented and continue to be implemented where possible. Work that promotes competitiveness is worth continuing and, as I mentioned, it must be a way of life.

JAN VAPAAVUORI
Minister of Economic Affairs

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Abstract

The premise for this work was to ensure that Finland maintains an internationally competitive manufacturing industry in the future. The most important goal was to create an understanding of what can be done and is worth doing for the industry to grow and increase the value added in Finland.

GOAL AND VISION

The following future vision was formed during the preparation of the industrial policy:

Finland has a diversified, continuously renewing manufacturing industry that understands global markets and produces high value added for Finland.

Although attaining this vision ultimately depends on the success of businesses (e.g., competitive products, successful business management), good industrial policy and smart public measures can support success. Thereby, the goal of the industrial policy must be to support sustainable economic growth. The success of this goal can be assessed with the growth of industrial value added. In order for industrial companies to bring about economic growth in Finland, the value added of their Finnish units must grow.

Also other goals can be and must be set for industrial activities. For example, with respect to the environmental sustainability, seeking reduced emissions appears sensible. Natural fossil resources can be replaced by renewable resources. From the perspective of the national security of supply, sufficient operative industrial capability should be maintained under all circumstances.

The manufacturing industry is comprised of companies that manufacture physical products or their parts. Many of these industrial companies also increasingly produce services. Companies that produce purely services are, however, excluded from the definition of manufacturing industry.

HOW HAS THE ROLE OF MANUFACTURING INDUSTRY CHANGED?

In all developed countries, the share of manufacturing industry from the total production (GDP) has decreased in the past decades. In these countries, the share of the industry has followed an inverted U curve. Most often, the path from an agrarian society to a service-dominated economy has gone through an industrial society. In this scenario, the share of the industry has increased and peaked at 30–40 percent. In Finland, the all-time peak was attained in 1974 when manufacturing industry,

defined broadly (manufacturing and other industrial branches), amounted to 32 percent of the gross domestic product. In the 2000s, the share varied between 25 and 28 percent until, in 2009, it fell to 20 percent. After this, the share has remained almost unchanged.

To date, other sectors have not been able to compensate for the decrease of manufacturing industry. This is shown in the development of the GDP and the exports. Unlike in many other countries, our exports are still at a clearly lower level than in 2007.

WHAT ARE THE RECENT CHANGES CAUSED BY?

The decrease in the industrial value added and exports can mostly be attributed to two lines of business: the electronics and forestry industries. Almost 9 billion euros has disappeared from the value added of the electronics industry alone over the past six years. In the forestry and paper industry, the fall is 1.5 billion. In addition, the value added in metals refining and manufacturing of metal products has dropped significantly.

What are these decreases owed to? In all three areas, the causes are slightly different. The fall of the electronics industry comes almost entirely from Nokia. The decline in the forestry and paper industry is largely attributable to the decreased demand for graphical products in the Western world. As a result, there has been excess capacity, which, in turn, has been eliminated by closing down factories. There are several reasons in the background for the decreasing value added of metal refining and metal products: lower prices obtained for metal refining, the loss of competitiveness resulting from increased expenses, tightening competition brought about by developing countries and the decline of demand for investment goods.

All in all, it is a matter of the “recipe” for producing value added being lost, one way or the other. There are potentially two primary reasons for this:

- 1) *Finland makes products whose demand is in decline.* The global demand has decreased, resulting in lowered exports and value added produced in Finland of these products.
- 2) *There is demand for the products of Finnish companies in the world but it is more profitable to produce them elsewhere than Finland.*

SELECTIVE OR HORIZONTAL INDUSTRIAL POLICY?

In all industrial and enterprise policy, a choice must be made on whether policy decisions are made for specific fields of business or technologies or whether the measures will apply to all fields alike (for example, a common corporate tax rate).

With globalisation, it is increasingly difficult to forecast the development of the lines of business, making failed choices more likely. Yet, a small and resource-limited country, such as Finland, will always have to make choices.

If choices are made, it is worthwhile for a small national economy to choose areas as independent from a business sector as possible, areas where there is a great belief in their potential. This way, the choices of focus areas will not apply to individual companies or lines of individual business. The focus should be on cross-cutting themes that affect almost all lines of business.

The choice of the focus areas should rely at least on the following principles:

- The focus area applies to all or almost all the lines of business.
- Finland has existing or developable competence related to the focus area.
- The choices support the general goal-setting of the industrial policy, i.e., in practice, sustainable economic growth and continuous ability to reform.
- The focus area is suitable for a small open economy with a high cost level, such as Finland's.

The possibilities of Finland lie in innovation-driven sectors and industries that aim to utilise our natural raw material resources. The following, at least, would be suitable for Finland:

1) *Cleantech*

Cleantech addresses global environmental challenges through technological means. It involves, among others, energy efficiency, efficiency of material use, recycling and reduction of emissions and the environmental load on a broader scale in a way that produces value added for the customers.

2) *Bio and natural resources economy*

Bioeconomy refers to an economy that sustainably relies on renewable natural resources to produce bio-based food, energy, products and services. Bioeconomy is expected to be the new wave of economy after the fossil economy. Finnish companies' world-class expertise in refining biomasses, our strong industrial foundation and plentiful forest resources whose growth for decades has exceeded the harvested volume provide a good premise for developing our bioeconomy. In utilising the natural resources, ground resources must be considered on a broad scale, for example, by including mining activities. Biotechnology also offers significant business opportunities for the health business.

3) *Digitalisation and new production technologies*

Digitalisation is breaking through in almost all products and services. Increasingly many products and production devices will interconnect with one another through an Internet of Things. According to forecasts, there will be a global shortage of top experts. ICT and automation provide new possibilities

for renewing business processes in leaps. Finland has a good premise for succeeding in several areas of digital activities.

These areas of focus have one thing in common: the associated products or services can be developed in almost all lines of business. Another shared factor is that they are global growth markets. Demand for products and services based on them will thus probably rise.

GLOBALISATION BREAKS DOWN NATIONAL CLUSTERS

A new feature of globalisation is that related functions and tasks no longer necessarily have to be located close to one another. Product development, component manufacturing and sub-assembling can all be located in different countries. The former national clusters have, therefore, become global value networks. For Finland and many other Western countries, this has meant losing work tasks to developing countries. The majority of the migrated workplaces have been in production tasks.

From the perspective of an individual country's gross domestic product, the question is the extent to which the value added of internationalised companies is produced in the country in question. At the company level, the value added is that which is produced by the units in the said countries.

The relationship between companies and national economy is increasingly complex. If companies move their functions to other countries, it is very possible (though not assured) that the national economy of the country of origin will benefit from it. The effect in the other direction is, however, clear. If companies are not successful, the national economy cannot be successful.

NATIONAL POLICY DURING THE ERA OF GLOBALISATION

The way multinational companies operate challenges national enterprise and industrial policy. National policy aims at increased well-being and a high standard of living in the homeland. On the other hand, the activities of a multinational company target several countries. The interests of a multinationally operating company differ from those of an individual national economy.

The internationalisation of companies has fundamental effects on several policy areas, the key items being:

- 1) From the perspective of *innovation policy*, it is essential to bear in mind that the contributions of innovation activities and their benefits may not apply to the same countries. This applies to both direct benefits of innovation activities (e.g., new jobs and country where profits are located) and indirect benefits (dissipation of new information). Innovation policy must increasingly attempt to channel the benefits to the homeland.

- 2) Globalisation presents special challenges to *education policy*. The success of companies in a fast-paced global business requires different skills than activities taking place only in the homeland. Analysing the global markets, understanding customer needs, marketing and sales in different cultures, integrating products and services into entities that produce value added, controlling a globally dispersed production network and contract law are examples of the competences required in the renewal of Finnish companies.
- 3) *Business and enterprise policy* can help ensure that Finland hosts the headquarters and key functions of companies and that companies generating new jobs will be established in Finland. Often the jobs with the highest salary levels are located in the headquarters of businesses (but also in research and development offices).

The ownership of intellectual properties, such as patents, brands and trademarks, is often in the country where the headquarters are. The state can, with its decisions, also affect how easy it is to set up a new company. In addition, its decisions can contribute to the kinds of consequences that the failure of a company has (e.g. bankruptcy legislation).

- 4) *Competitiveness* touches on several policy blocks on a broad scale. For example, transportation, communication and other policies affect how easily and quickly goods, services, people and information will move across the borders. The significance of the mobility of these items is increasingly large, as companies, units or individuals from many countries participate in producing an increasing number of products and services. A functioning road, railroad, maritime and air traffic infrastructure is important. Quick visa and work permit handling, in turn, makes it faster for people to move. In addition, the functioning of the labour market in the changing environment faces new requirements.

WHAT DOES INDUSTRIAL GROWTH IN FINLAND REQUIRE?

The value added of manufacturing industry can grow in two main ways. The first alternative is for the number of products or the related services to increase. The second alternative is for the unit value of goods or the related services produced in Finland to increase. Thus, an individual product would yield a higher price while the cost of import inputs would remain the same or grow more slowly. In this case, the value added generated by a single product would increase. The growth of the value added would require innovation activities, which can equally be technology or brand-related.

The significant growth of the Finnish manufacturing industry requires success in **four so-called transitions**.

The manufacturing industry must do the following better than it presently does:

- 1) tap into global challenges and customer needs,
- 2) build a true competitive advantage from innovations and
- 3) create a good position in global value networks.
- 4) In addition, Finland as a national economy must increase its industrial resilience and ensure that the value is channelled to the homeland.

It is evident that success in these areas depends on the companies themselves. The public sector can create premises and, to some extent, facilitate the transitions.

WHAT POLICY MEASURES HAVE BEEN TAKEN AND WHAT WORK REMAINS?

The general competitiveness of the national economy is the foundation of policies. Companies will invest in Finland only if Finland is a sufficiently attractive investment target and the profit expectations for the investments are sufficiently good. Jyrki Katainen's government has commissioned several reports aiming to improve the competitiveness of the operating environment of enterprises including the manufacturing industry. The presented measures have also been implemented. The government has, for example, continued measures for balancing the public economy. The corporate tax rate has been lowered. The Team Finland operating model for promoting the internationalisation of businesses has been implemented. Work has been done to promote competitiveness, but plenty remains to be done. One special challenge is posed by the development of Finland's age structure. Ensuring the amount of work contributions is one of the key sources of economic growth.

In this report, the main attention will be on the renewal of the industrial company sector. Companies are primarily responsible for making the four transitions listed. Our proposal is that in order to support growth-seeking reform of companies, dialogue between the public sector and the enterprises must be strengthened. The dialogue helps identify obstacles to growth-seeking reform. At the same time, the means of the public government will be harnessed more effectively to support the goal. It is a matter of how we, as a nation, can utilise our competitiveness.

Our ability to innovate is the key issue. Public innovation policy should aim more effectively for the renewal of manufacturing companies. By means of public special funding and the development of the finance market, an attempt is made to promote the growth of industrial companies. The promotion of the exports and internationalisation of industrial SMEs will be a special goal. Strategic programmes in the areas of bioeconomy and cleantech are used to increase value added. The possibilities of manufacturing industries to better utilise digitalisation will be promoted programmatically. Additional measures to increase value added will be identified through dialogue.

At all times, it must be borne in mind that the premises for economic growth also exist in other business areas, particularly in the service sector.

1 Introduction

1.1 Background

This publication discusses the changing nature of manufacturing industry,¹ the present state of the Finnish manufacturing industry and the basics of the industrial policy² that apply to the manufacturing industry. Finally, it presents steps for growth-seeking industrial reform for Finland.

The aim is to draw a comprehensive and analytical picture of the central trends of global manufacturing industry and the key underlying drivers of change that can be identified. It is important to understand the global context in order to be able to understand the reasons and background of the structural change of Finnish manufacturing industry as well.

Manufacturing industry has traditionally been the main driver of economic growth. The success of industrial activities radiates more broadly to the entire national economy and to the rest of society. The role of manufacturing industry as a source of economic growth is, however, constantly changing. What once improved the well-being of the national economy may not necessarily do so now. In order to understand the present state of Finnish manufacturing industry, we must understand not only global developments but also the roots of our own enterprise structure and industrial activities.

A common goal of the enterprise policy is sustainable economic growth. As an indicator of economic growth, GDP per capita is still the best one available. In this review, we shall pay particular attention to how the value added of industrial activities is channelled into the gross domestic product of national economies and what this requires of policies and business activities. However, the dimensions of sustainability as a qualitative attribute of economic growth vary. Economic growth cannot be sought at all costs. The requirements of environmental protection, fairness etc. often bring constraints. Sustainability also requires resilience. One dimension of sustainability is brought about by the requirement of security of supply.

We set the following as the vision of reforming industrial policy: *Finland has a diversified, continuously renewing manufacturing industry that understands global markets and produces high value added for Finland.*

The Ministry of the Employment and the Economy's discussion on industrial policy is based on the Industrial Competitiveness Approach published by the ministry

¹ Industrial manufacturing, TOL 2008 class C (in Standard Industrial Classification, SIC).

² We want to emphasise the industrial policy whole. While this report focuses on discussing matters of the manufacturing industry, it is, for the sake of convenience, sometimes easier to use the term industrial policy although we continuously wish to emphasise breaking the barrier between manufacturing and services and, also for this reason, the primary nature of general enterprise policy.

in March 2013.³ Its second recommendation stated that “Strategic dialogue must be initiated in Finland on a new manufacturing policy and a roadmap aiming at renewal must be created.” We see that the obstacles of industrial activities should be identified and a stronger foundation and means for renewal should be found through dialogue.

The work progressed as the assignment of Jyrki Katainen’s administration’s structural policy programme on 2 June 2013 set the goal to strengthen Finland’s industrial foundation. The report of that time⁴ was submitted as part of the Ministry of Employment and the Economy’s structural policy material. The material related to this material was produced as the result of collaboration between the ministry, the consulting firm McKinsey, The Finnish Economic Research Centre (ETLA), VTT Technical Research Centre of Finland, Tekes – the Finnish Funding Agency for Innovation, Finnvera (specialised funding agency owned by the State of Finland), Industry Investment (TESI) and representatives of the industry. Other key actors have made valuable contributions to the work. On 15 January 2014, the Minister of Economic Affairs, Jan Vapaavuori, arranged the Selkäranka (Backbone) seminar where a significant group of representatives of society and the enterprise sector discussed the topic. The government discussed the summary of that report in its informal meeting on 10 March 2014.

This report aims at assembling the accrued material. The first part of the report discusses global trends that shape the industry. The second part inspects the development and present state of Finland’s manufacturing industry. The third part presents conclusions and policy definitions for reforming Finland’s manufacturing industry.

Growth-seeking renewal of industrial activities can ultimately take place only in companies. The state’s role is primarily one of support and enabling the reform. As the interest is common and national, we wish to present means for initiating dialogue.

The global manufacturing industry is facing new challenges and possibilities. Many past truths must be re-evaluated. At the same time, new and interesting possibilities open for industrial activities in developed and developing countries alike. With the environment changing, the connection between our own national goals and means should be strengthened.

1.2 New coming of the industrial policy

The financial and economic crises, the strong industrial march of the rising economies, new technologies and the concern for jobs and development of the enterprise structure have all been topics of recent dialogue regarding enterprise

3 http://www.tem.fi/files/35777/TEMjul_5_2013_web.pdf. The policy definition aimed to also take into consideration the investigator reports of Matti Alahuhta, Jorma Eloranta, Kari Stadigh and Pekka Ala-Pietilä.

4 <http://valtioneuvosto.fi/etusivu/rakenneuudistus395285/tiedostot/ministerioiden-materiaalit-15112013/tem/TEM-aineistot-4-15112013.pdf>

policy in general and the significance of industrial manufacturing in particular. The matter has been considered in individual countries and among international organisations.

One good way of studying the basics of a policy is to probe the discussions on the topic carried out in the OECD. Ken Warwick⁵ discusses the development of enterprise policy (industrial policy)⁶ and new rising trends from the perspectives of policy goal setting, target, rationality and the area and orientation of the policy.⁷

It is important to keep the goal clear in order to be successful in assessing the success of the policy. Warwick defines the **goal of industrial policy** as follows: *Industrial Policy is any type of intervention or government policy that attempts to improve the business environment or to alter the structure of economic activity toward sectors, technologies or tasks that are expected to offer better prospects for economic growth or societal welfare than would occur in the absence of such intervention.* A central goal, thus, is attaining economic growth. At the same time, other goals can be set for society. Because of its general nature, Warwick's definition borders the broad-scale enterprise policy but can be well applied to evaluating specifically the manufacturing industry.

In Warwick's structuring, the **target of a policy** can be a sector, a technology, a production factor such as research and development or a part of the value chain. The **policy rationale**, i.e., the philosophical orientation, on the other hand, examines whether a market mechanism is believed to solve distribution matters independently or whether the market shortfall should be rectified and, if so, on what grounds.

The **areas of policy** may apply to the traditional competition factors, competences, capital markets, land use and zoning etc. that apply to the markets (table 1). In addition, as a new field Warwick highlights the promotion of co-ordination and information flows, the building of institutions, the promotion of entrepreneurship and other systemic functions related to the interaction and dialogue between markets, economic actors and the government.

The **orientation of a policy** can be interpreted according to figure 1 in relation to whether the policy is horizontal, i.e., treating all parties equally at least in principle, or whether it is selective. A horizontal policy aims primarily to create framework conditions.

5 Ken Warwick was a long-time leader of OECD's Committee on Industry, Innovation and Entrepreneurship (CIIE).
6 It is not unambiguous to define industrial policy as a concept. The long span of industrial policy can be visualised for example through historical development. As societies were developing from agrarian to industrial and further to service-dominated economies, it has always been necessary to rethink the premises and foundations of the policy. The terms are born into their contexts. In its most natural form, industrial policy as a term describes the industrialisation stage. The return of the term now is partly owing to the manufacturing industry undergoing major change.

The English language term industrial policy can be understood as a synonym of the Finnish language term enterprise policy. On the other hand, it can be used to emphasise matters of the manufacturing industry. Unfortunately, English has no specific term to describe general enterprise policy, unlike in Swedish (näringspolitik, industripolitik). Enabled by Finnish, this report will occasionally refer to the term industrial policy to emphasise the special matters of the manufacturing industry. The emphasis is, as stated above, continuously on the significance of the common enterprise policy. Enterprise policy is a hypernym that also covers industrial manufacturing.

7 <http://www.oecd-ilibrary.org/content/workingpaper/5k4869clwoxp-en>

A **selective policy** is either **strategic or defensive (reactive)**. A defensive selective policy is a case where existing economic structures are defended, typically in situations of overcapacity.

Strategic selectivity can be divided into a four-quadrant diagram as illustrated in figure 2. The catch-up countries can aim to increase their own comparative advantages by building on existing strengths (C) or they can seek new comparative advantages and challenge others (D). The frontier countries, such as Finland, on the other hand, can consolidate on their existing comparative strengths (B) or seek new comparative advantages with a strategic approach (A).

Selectivity must be viewed through general goal-setting. The basis of a discriminating (selective) policy must, as a general rule, be growth and possibly other societal goals.

If the policy is strategically selective, the types of processes and institution arrangements with which the choices are made become important. For example, line-of-business-specific structures can promote the information and dialogue of the strategic areas and remove obstacles to growth. With new areas typically lacking a representative, it must simultaneously be made possible for areas yet unknown to emerge. At least in theory, it is possible to take strategic selectivity so far that strategic areas are identified and competitiveness strategies are prepared for them.

The more selective the implemented policy is, the more aware one must be of the government failure risk involved with political decisions. Often public interventions are justified with actual or imagined market failure. It is important but often very difficult to assess industrial policy, as there are few successful evaluations.

Also Finland must ask whether we want to apply just a horizontal policy or whether we selectively seek something. The shipbuilding industry can be used as an example of defensive selectivity. It is possible for defensive selectivity to be successful in a situation where global overcapacity is released. This way, Finland can aim to gain market shares by winning time. Naturally, this has a price. On the other hand, we can be strategically selective and build on our existing strengths, for example by increasing innovation activities in some of our stronger areas or by seeking new strengths. An example of the latter is the strong increase of research and development in certain predictable growth areas, such as digitalisation and bioeconomy.

Generally speaking, it can be said that horizontal industrial policy is the so-called safe choice. As clusters make space for global networks, countries will increasingly compete for various tasks. The best and the best paid tasks are the most attractive. Up to 70% of the global trade involves intermediate products and components. The value chains break down and reduce the significance of regional clusters. Increasing co-ordination competence should be the core of the policy.

A small country will also have to carry out selective policy. Here, the fact that we do not have the resources to promote education, research and development in all areas will suffice as a justification. A good example of Finnish choices is the VTT

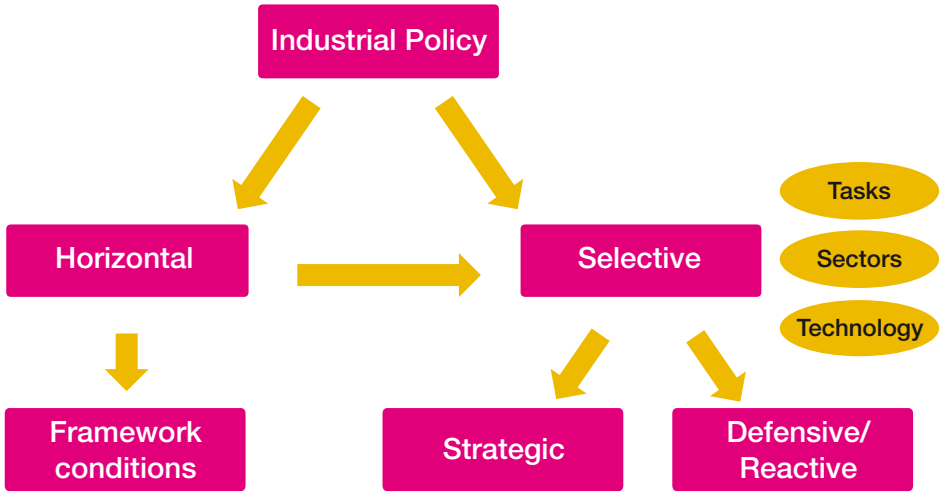
strategy. A general question, then, is whether the selective policy is sufficiently co-ordinated at the national level in order to obtain full power from the resources also from a broader perspective.

Several countries have made industrial policy initiatives in recent years. Some have consciously chosen certain areas as strategic ones. Some examples include France (energy, transportation, environment, healthcare and information technology), Japan (infrastructure-related areas, infrastructure exports, environment and energy, problem-solving, culture, tourism and gastronomy, medicine and healthcare, as well as traditional strengths, such as robotics, space and aviation), Korea (green technology, high-technology convergence technologies and services bringing high value added) and The Netherlands (water, nutrition, garden farming, chemicals, energy, logistics and creative fields). Many other countries, such as Turkey, the UK, China and India have policies that contain sector-specific choices of focus.

The United States does not consciously carry out industrial policy and likes to speak solely of innovation policy. It is, however, essential to note how the country has utilised its position as a superpower through broad collaborations between the defence and civilian sectors. The American innovation policy is often mission-driven. The superpower invests significantly in solving a problem or task and thus attains breakthroughs. For example, Arpanet, developed for military use, became the Internet. Correspondingly, the roots of GPS technology lie in U.S. military technology. During the past decade, the United States has taken control of the digital world, and it would appear that Europe, for example, has no counter-force to offer to this development.

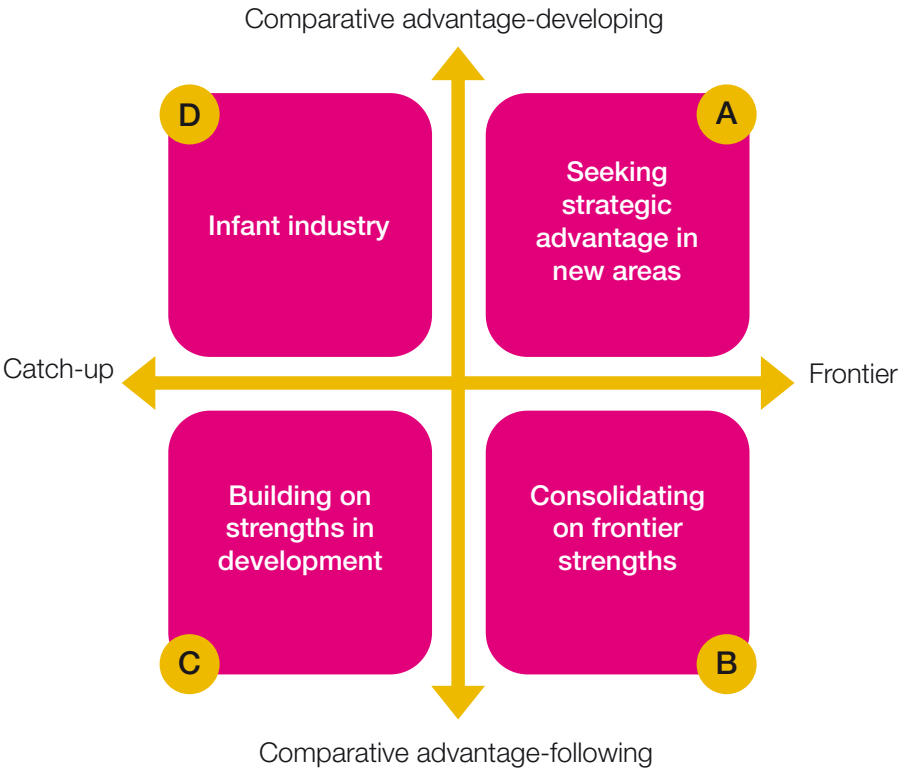
EU's common industrial policy has been stated in the flagship project involving the Europe 2020 strategy's industrial policy and the European Commission's communication on it. OECD's research programme for the coming years includes the investigation of the analysis of value chains and a research project dubbed the New Industrial Revolution.

Figure 1. Classification of enterprise/industrial policy according to orientation



Source: Beyond Industrial Policy: Emerging Issues and New Trends. Ken Warwick. OECD 2013.

Figure 2. Classification of strategic-selective industrial policy



Source: Beyond Industrial Policy: Emerging Issues and New Trends. Ken Warwick. OECD 2013.

Table 1. Some examples of policy instruments by policy domain and orientation in certain countries.

Domain	Horizontal policies	Selective policies
Product Markets	<ul style="list-style-type: none"> Competition and anti-trust Indirect tax Product market regulation Exchange rate policy 	<ul style="list-style-type: none"> National champions Nationalisation/privatisation Output subsidies/state aids Export promotion Price regulation (e.g. pharma) Public procurement Trade policy Car scrappage
Labour and skills	<ul style="list-style-type: none"> Skills and education policies Training subsidies Wage subsidies Income and employment tax Management advisory services Labour market regulation 	<ul style="list-style-type: none"> Targeted skills policies Apprenticeship policies Sector-specific advisory services
Capital markets	<ul style="list-style-type: none"> Loan guarantees Corporate tax/capital allowances Macro/financial stability Financial market regulation 	<ul style="list-style-type: none"> Strategic Investment Fund Emergency Loans State Investment Bank Inward investment promotion
Land	<ul style="list-style-type: none"> Planning regulation Land use planning 	<ul style="list-style-type: none"> Enterprise zones Place-based clusters policy Infrastructure
Technology	<ul style="list-style-type: none"> R&D tax credit Science Budget IPR regime 	<ul style="list-style-type: none"> Green technology Lead Markets Public procurement for innovation Patent box Selective technology funding Centres of expertise
Systems/Institutions	<ul style="list-style-type: none"> Entrepreneurship policy Scenario planning Distribution of information Overall competitiveness strategy 	<ul style="list-style-type: none"> Indicative planning Foresight initiatives Identifying strategic sectors Sectoral competitiveness strategy Clusters policy

Source: Beyond Industrial Policy: Emerging Issues and New Trends. Ken Warwick. OECD 2013.

2 Global trends of manufacturing industry

2.1 Manufacturing industry and value chains⁸

GLOBALISATION BREAKS DOWN NATIONAL CLUSTERS

A central trend affecting the activity of manufacturing industry is related to the break-down of global supply and value chains. In many cases, national clusters have had to make space for international networks. Below, it will become apparent that this largely applies to industries important to Finland.

As late as in the early 1990s, Finland had many national clusters. They consisted of companies similar to one another at the functional or technological level and close geographically. What was important for the competitive advantage of these clusters was their mutual connection and interaction. An international analysis showed that successful clusters were concentrated in certain countries and areas.⁹

The clusters were strongly based on geographical proximity. In particular in Finland, one important characteristic of the clusters was that the champion companies had subassemblies done and acquired components primarily from nearby areas. The delivery chains thus formed were largely national. However, particularly in small countries such as Finland, procurements were also made elsewhere.

Over the past couple decades, many clusters have changed. Companies have specialised in increasingly narrow fields. Functions not included in the core competence have been outsourced. Along with this development, chains have gotten longer.

In the global economy, dozens of companies may be involved in producing even the simplest products. With more complex products, the number of companies easily grows even to hundreds. The delivery chains or networks, to use a better term, has grown and become more complex. Increasingly, these networks operate in several countries and continents. The networks have become global.

A greater yet change applies to the location of the parts and work tasks of the value chain. While different work tasks related to each other were previously physically close to each other, this may not necessarily be the case today. The adhesive that used to keep the work tasks close to each other has become diluted.

The dilution has been brought about by two fundamental changes. The first of these is the decreased significance of the cost of transportation. With that, it is profitable to create subassemblies and end products in different places. Raw materials are refined in one place and taken to further refining to the next place.

8 The authors of the report have relied on the expertise of ETLA. In many places and, particularly in this section, ETLA's researcher Jyrki Ali-Yrkkö has had a key position.

9 Michael E. Porter. The Competitive Advantage of Nations. 1990.

The same is repeated with subassemblies and the end assembly. Another change is the real-time communication across the globe brought about by information and communication technology.

The speed and reliability of communication have lowered the cost of co-ordination caused by distributed activities. Without information networks, data exchange would be slow and difficult. Network co-ordination and management are the most important tasks of multinational companies. The one that can have suppliers compete with each other and manage the supplier and distribution channels is able to channel part of the value created by others into its own business. Political development has enabled the utilisation of the abovementioned technical development.¹⁰

The globalisation of value chains does not apply solely to functions **between** companies. The same can be seen **within** companies that operate multinationally. One company or group can easily have dozens or even hundreds of sites across the world. Manufacturing industry has most often worked at the forefront of development. From the perspective of Finland's national economy, it is important that Finnish multinational companies assign high value added tasks to units in Finland and channel the produced value to Finland also at the corporate level. This same goal can of course be set for all foreign subsidiaries operating in Finland.

As will be observed later when the various industrial segments are described, not every value network is alike. The value networks of products aimed at the global consumer market differ from the almost unique value networks of machines aimed at businesses. Correspondingly, the networks of foodstuff sold as fresh goods can often differ from the networks of preserves. In addition, for example in the electronics industry, national clusters first became global value networks with the migration of their component manufacturing to countries with lower costs level. In the second stage, the network parts began to approach each other. This clustering took place in China where an enormous electronics industry cluster has been formed. As a result, the consumer electronic industry in particular has virtually vanished from many Western countries.

SIGNIFICANCE OF GLOBALISATION FOR COMPANIES

The globalisation of value networks means increasingly intensified specialisation. On a global market, a company can specialise in an increasingly narrow field. Particularly in small countries, the size of the home market would often not be sufficient for a specialised company. From the company's perspective, the goal is to specialise in the management of global value chains, i.e., work as the captain or orchestrator of the value chain.

Another significant issue is that companies can utilise the competitive advantages of different countries and areas. Competence is obtained from where it can best

¹⁰ There is also the general liberation of the global economy in the background. Multilateral, regular global trade has become institutionalised in WTO agreements, for instance. After the end of the Second World War, the unobstructed passage of maritime traffic and goods flow in global trade have, from the perspective of the global politics, been ultimately secured by the United States' naval supremacy on the Atlantic and Pacific Oceans.

be gotten. Correspondingly, companies utilise the cost levels of different areas. If manufacturing is cheaper in a certain place, it will be utilised. Previously, companies had to choose their location so that they did not simultaneously attain low costs and high competence. Now both can be attained. It is simply necessary to decentralise various functions and work tasks to different places.

A third feature brought about by globalisation is that competition has intensified. Companies from different countries are located across the world. Companies that used to deal with purely domestic competition or competition from nearby countries are now in the middle of a global redistribution of the market. In addition to their former competitors, the companies are now competing with the leading companies of the world. For Finland, this will be a difficult challenge for many small and medium-sized industrial enterprises. While they used to carry out indirect exports with our large champion companies serving as their distribution channels to the world, they now face competition from global companies which the champions increasingly use. The former distribution channel of Finnish SMEs has been cut. The challenge they face is to obtain customers from abroad by themselves.

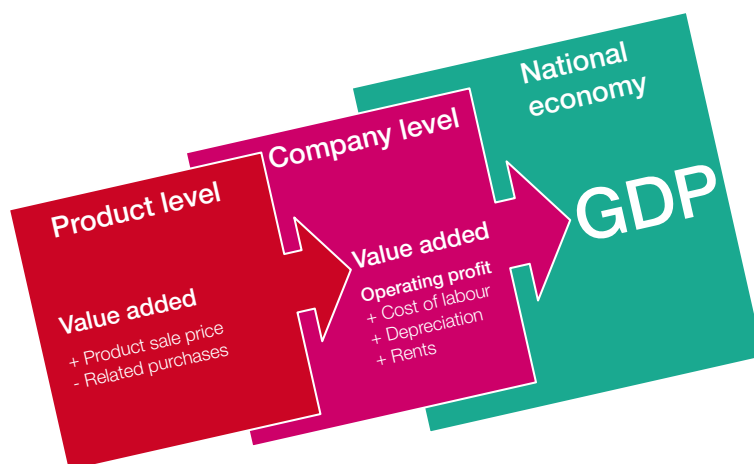
THE INTERESTS OF BUSINESSES AND THE NATIONAL ECONOMY GO DIFFERENT PATHS

Companies operating in a multinational way create a totally new situation between businesses and individual national economies. This new situation also impacts the position of SMEs. Just a few decades ago companies and the entire national economy shared similar interests. For example, if companies were to increase their exports, the growth could be seen at the level of the entire national economy. Money flowed in from abroad.

At present, the relationship between companies and the national economy is more complex. If companies move their functions to other countries, it is not self-evident the national economy of the country of origin will benefit from it. The effect in the other direction is, however, clear. If companies are not successful, the national economy cannot be successful.

From the perspective of the gross domestic product, the question is the extent to which the value added of internationalised companies is produced in that country. At the company level, the value added is that which is produced or reported by its units in the countries in question. The value added produced by companies is created through their own products and services (figure 3).

Figure 3. Creation of gross domestic product



If the GDP created by the private sector is wanted to increase, the value added produced by the companies in the homeland must grow. A company operating internationally can make an individual national economy grow in a variety of ways. The most traditional one is the export of goods. A newer way is compensations paid by the foreign units of a multinational company for intra-group services. The units in different countries benefit from each other and they should also pay for the benefits they gain regardless of whether the benefit producer is external to the group or part of the group. Intra-group payments can be management fees, for instance, which subsidiaries pay to the head office. In addition, subsidiaries can pay royalty or licence fees to the head office for patents, brands or other intellectual property. This income increases the service export of the head office country and, subsequently, the value added. As shown later, the Nokia example illustrates well this development.

VALUE CHAINS CONNECT LINES OF BUSINESSES WITH ONE ANOTHER

Value chains connect companies from different lines of businesses with one another. The competitiveness of a single company, product or service does not depend solely on one company but also on other companies in its network. The same applies to the entire industry. The competitiveness of industrial companies also depends on their connections with service industries and the competition that takes place there. If another sector, such as office building or retail, has shortcomings in the competition, the consequences are reflected in the entire economy.

A bit more than a quarter of Finland's exports is service exports (Statistics Finland 2013), which leaves almost 75% as the export share of goods. These figures are the share of gross exports in the national economy. For a better understanding of the national economy, it is, however, more important to look at the value added based

exports. Recent data indicates that, when calculated based on the value added, the share of services rises slightly above 50 % (OECD 2009). Even if the end product that is exported is a physical item, there are a significant amount of service-type purchases behind it.

Industrial companies' strong or weak competitiveness thus depends on others as well. Behind a competitive product or service there is also a competitive network.

EU AND OTHER REGIONAL CONCENTRATIONS

The world is divided more clearly than before into three economic areas where a significant part of the value chains' business transactions are concentrated. In Europe, the value chains are increasingly concentrated around Germany. In the NAFTA region, the role of the United States is central. In Asia, Japan and China are the primus motors. China concentrates, at least for now, in manufacturing functions.

Of the exports of the EU area, foreign value added, i.e., produced outside of the EU, amounted to approximately 14 % in 2009.¹¹ This corresponds to the shares of countries such as the U.S. and Japan. The shares of individual EU countries are considerably larger and reflect the significance of trade within the EU area. For Finland and Sweden, the share of imported input of the value added was approximately 33 % in 2009. As late as in 1995, the share was 27 %. The share of Germany has also increased from 19 % in 1995 to approximately 27 % in 2009. The greatest share was in Luxemburg, approximately 60 %, while the UK had the lowest one, approximately 18 %. The former is explained by the country's status as a transit country, while the latter is explained with the British economy being service-dominated.

The emphasis of Germany's position in the European manufacturing industry's value chains is shown in automotive manufacturing, for example. When a car is exported from Germany, typically a third of the value added originates from the imported inputs of other countries. Germany imports intermediate products for transportation instruments particularly from France, Italy and the UK. The participation of the Central and Eastern European countries in the various stages of the value chain has, however, grown as German companies utilise the lower cost of labour in Eastern Europe. The share of foreign imported inputs is particularly high with respect to basic metals, chemicals, minerals and transportation vehicles.

Trade among the abovementioned three economic areas differs by sector. In chemical industry, intermediate products from the U.S., China and Japan are used in the manufacture of end products produced elsewhere. For example, in the electronics industry, China-based assembly uses intermediate products from the US and Japan as high-technology export components. The automotive industry manifests a stronger geographical concentration.

11 Koen de Backer, Sébastien Miroudot and Alexander Ragoussis. *Manufacturing Europe's Future*. Bruegel Blueprint Series. 2013.

2.2 The manufacturing industry's value added, impact on employment and share of the enterprise structure

VALUE ADDED OF INDUSTRIAL PRODUCTION¹²

The value of industrial production has increased in developed and developing countries alike. Using the prices of 2000, the value added of industrial production grew between 2000 and 2010 from USD 5.7 trillion to USD 7.5 trillion. The growth has been faster in large developing countries, particularly in China. The USD 10.5 trillion value added of the manufacturing industry (at 2010 prices) in 2010 represented approximately 16 % of the world's GDP.

The share of manufacturing industry of the GDP appears to follow a U shape where the development of a country will at some point decrease the manufacturing industry's share of the GDP while the share of services will rise (figures 4 and 5). The GDP's share of industrial manufacturing will increase when a country develops from an agrarian society toward the industrial stage. The peak level is reached usually at 30–40 %. After this, as the national economy develops toward a high-income-level service society, the manufacturing industry's share of the GDP typically decreases.¹³

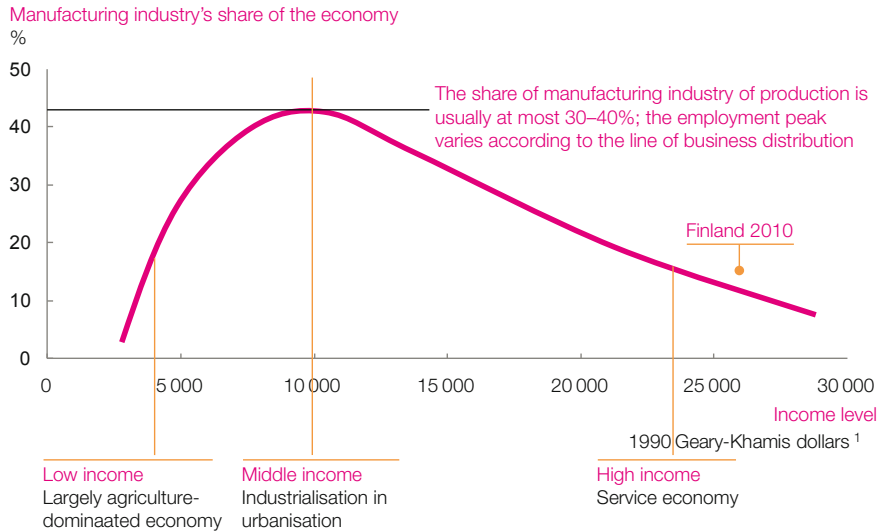
If the goal of the economic and enterprise policy is economic growth, it is logical to strive for growing value added for the manufacturing industry, not increasing the industry's GDP share.

12 Global statistics are largely based on the material of the Global Manufacturing 2012 publication by McKinsey. They, in turn, are most often based on the statistics produced by the World Bank.

13 As an example, we can compare the share of the industry in certain countries of their GDP and the GDP per capita (USD) in 2011: the US 12% (USD 48,400), Germany 19% (USD 37,900), Finland 19% (USD 36,200) and China 33% (USD 8,300).

Figure 4. Typical development of the industry's value added in the various stages of development of economies

The manufacturing industry's share of the GDP increases while economies develop and decreases as they become wealthier according to a reverse U curve



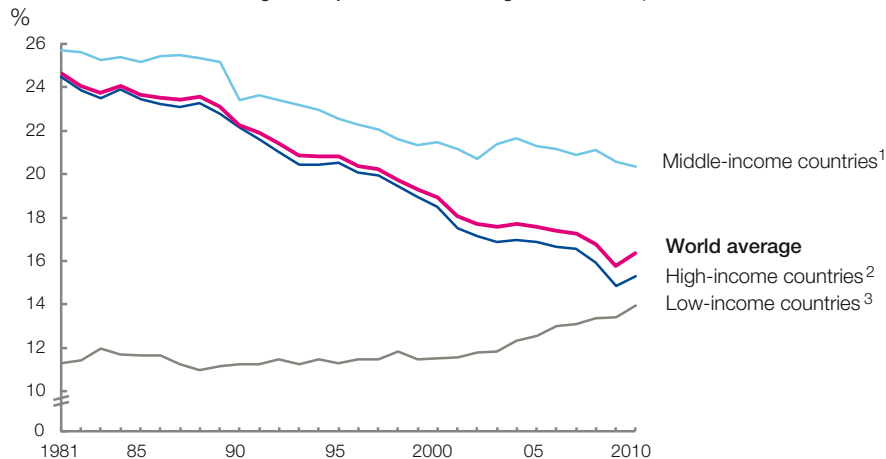
1 The 1990 Geary-Khamis dollar is a hypothetical monetary unit that enables international comparisons adjusted according to exchange rates and purchase power parity.

2 The World Bank's figures have been used in order to maintain consistency in international comparison (including energy).

SOURCES: McKinsey Global Institute analysis, World Bank and OECD

Figure 5. The manufacturing industry's GDP share has decreased everywhere except for the poorest countries

Value added of manufacturing industry as a share of the gross domestic product



1 GDP per capita \$1,006–\$12,275. Example based on the following countries: India (lower middle level), China (upper middle level), Russia, Thailand

2 GDP per capita \$12,276 or more. Example based on the following countries: EU countries, the U.S.

3 GDP per capita \$1,005 or less. Example based on the following countries: Kenya, Nepal, Tanzania

Source: World Bank; McKinsey Global Institute analysis

THE EMPLOYMENT EFFECT OF MANUFACTURING INDUSTRY

The number of employees working in the manufacturing industry grew globally from 270 million in 2000 to 300 million at the end of the decade. McKinsey estimates that the number of industrial jobs will rise globally by 2030 to approximately 400 million.

In 2000, the developed countries had 62 million industrial jobs. By 2010, the number had decreased to 45 million. McKinsey estimates that if the trends of demand and trade do not change drastically, the number of industrial jobs will decrease by 2030 to 40 million, which would be about 10 percent of all jobs (figure 7).

For example, in 2000, the United States had 17 million manufacturing jobs, while the number had dropped to 11 million in 2010. Approximately 500,000 jobs came back by 2012, but a major rise in the number of jobs is not expected. In Germany, the number of industrial jobs decreased by 8 % during the same period, while in Japan they fell by 21 % and in South Korea by 11 %. In Finland, the number of industrial jobs is currently at around 350,000. For the past decades, an up-and-down movement can be detected in the employment in Finland. The number of industrial jobs decreased after the depression of the early 1990s and rose back to almost half a million by 2000. Since 2008, employment has been on the decline.

The growth of employment in the past decades has taken place mostly in Asia where China is the prime mover. A natural driving force for this development has been Asia's richly populated countries getting wealthier and entering global trade.

The transition of employment to China and Asia has been not only the consequence of the value chain development described above but also the result of China's conscious export-driven economic policy that favours its coastal regions. China has attracted foreign investments with inexpensive labour costs, for example. This has been owed to its employment policy on the one hand but also to the so-called catch-up policy with which the transfer of knowledge has been sought.

Recent analyses forecast that this trend is turning and that globalisation is progressing to the next stage.¹⁴ China is losing its headway in the cost competition, which is the reason its potential successors are looking for their share of the industrial manufacturing jobs. It has been predicted that countries bordering mostly the Indian Ocean with a total population of approximately 1 billion people could take China's place (the so-called Post China 16 group).

14 <http://www.stratfor.com/weekly/recognizing-end-chinese-economic-miracle>, <http://www.stratfor.com/weekly/pc16-identifying-chinas-successors>

Figure 6. Post-China 16 national economies



Source: Stratfor

The decline of manufacturing industry employment in the developed countries is explained by the transfer of manufacturing jobs close to the market and lower costs. On the other hand, the decline of employment is explained particularly by the increased productivity based on automation and other technologies.

The job transfers began in the labour-intensive commodities industry (textile etc.) and they have continued, also affecting other segments. The financial crisis that began in 2008 has significantly affected the outlook of global demand. If the growth of the global economy starts again with the next one billion people gradually joining the global consumption demand, the increased demand will bring more employment. The employment effect will at least partly be countered by increased productivity attained through technological development.

In developed countries, the restructuring of industrial activities has produced evidence that work life is increasingly polarised. There is a shortage of people with top skills. In addition, there is also some demand for low-skill work tasks. The structural change is particularly demanding on the middle class.

For example, in the United States, the traditional American promise of wellness has often been realised as the increase of salaries and standard of living through (industrial) companies. The real income of the middle class has, however, remained unchanged and, compared to the 1950s, for example, maintaining the standard of

living of an average household requires two people working instead of one.¹⁵ The increase of the agility of companies has been behind this. The companies have been agile in utilising the possibilities of globalisation, and Corporate America has been successful. The profit accrued has been invested profitably and the financial worth of the companies has grown. From the perspective of societal integrity and the traditional promise given to the American middle class, however, the development has faced challenges.

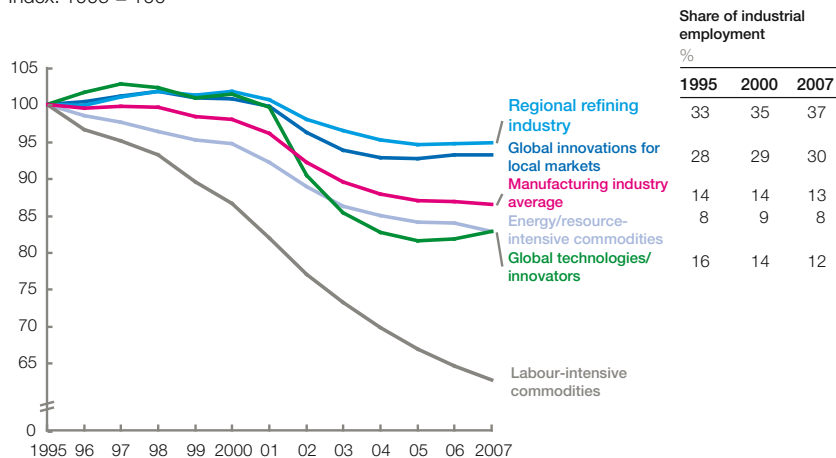
In Europe, the societal development caused by the reforming of manufacturing industry has partly been in the same direction. The European social model is, however, proving financially unsustainable. Dissatisfaction is easily channelled towards the existing governing establishments.

The labour market and other social models created for the earlier industrial society do not work optimally in the new situation. In principle, the models should simultaneously guarantee the efficiency of the national economy and the possibility of social mobility combined with sufficient income and societal cohesion.

Figure 7. Development of industrial jobs in developed countries by segment

Industrial employment has decreased in the advanced economies in all groups of lines of business but in labour-intensive commodities in particular

Development of industrial employment by sector in select developed economies, 1995–2007 ¹
Index: 1995 = 100



¹ Sampling of 17 developed economies: EU-15, Japan and the U.S.
Note: The total numbers may not match because of rounding

SOURCES: EU KLEMS; OECD; McKinsey Global Institute analysis

15 The median household income of Americans in 2011 was USD 49,103. Adjusted for inflation, the median income is just below what it was in 1989 and is USD 4,000 less than it was in 2000. Take-home income is a bit less than USD 40,000 when Social Security and state and federal taxes are included. That means a monthly income, per household, of about USD 3,300. It is critical to bear in mind that half of all American households earn less than this. It is also vital to consider not the difference between 1990 and 2011, but the difference between the 1950s and 1960s and the 21st century. This is where the difference in the meaning of middle class becomes most apparent. In the 1950s and 1960s, the median income allowed you to live with a single earner—normally the husband, with the wife typically working as homemaker—and roughly three children. It permitted the purchase of modest tract housing, one late model car and an older one. It allowed families to drive to a vacation somewhere and, if they were careful, save money as well.

Read more: The Crisis of the Middle Class and American Power / Stratfor

MANUFACTURING INDUSTRY AS PART OF THE ENTERPRISE STRUCTURE

With national economies becoming wealthier, their enterprise structure will change. The share of primary production will typically fall below 10 % of the GDP. In Finland it is currently approximately 2.7 % while it was 10 % in the 1970s. Behind the development is the enormous growth of agricultural productivity. Without the so-called green revolution, feeding the existing population would not even be possible. Similarly, productivity development of manufacturing has been high to date but new technologies that can be anticipated will further increase it.

The remaining part of the enterprise structure is comprised of public and private services, the share of which even in Finland is approximately 70 % and 80 % in the U.S. As late as in the 1970s, the share of services in Finland's gross domestic product was approximately 50 %. Public services explain part of the growth but the majority of the growth is attributable to the private service sector. From the perspective of productivity increase, it is specifically important to pay attention not only to the development of industrial development but also the development of the service sector.

Services and the manufacturing industry are often interconnected. For example, out of the 11.5 million industrial workers in the United States, an estimated million work in various service-type tasks. Thus, the number of jobs related to manufacturing per se is only 6.5 million. On the other hand, manufacturing industry is directly served by 4.7 million service-sector workers. Calculated in this manner, manufacturing industry employs 17 million people in the United States.

Although the significance of manufacturing industry, as described above, changes, its significance in national economies continues to be central with respect to services and also productivity growth, innovation activities, international trading and the security of supply.

MEGATRENDS THAT GUIDE INDUSTRIAL DEMAND

Global trends shape the trends for industrial products. Successful companies can anticipate changes in trends and adjust their operations. For agile national economies, the capability to anticipate creates a competitive advantage.

Population growth will increase the demand for food and raw materials. The need for energy will increase and the methods for producing primary energy will be strongly connected with environmental factors. There is a greater need for production that reduces environmental load while being resource-efficient.

The growth will not be distributed evenly. In Europe, the population will decrease while it grows the fastest in Africa. The average age of the world's population is growing. The focus of demand will shift to developing markets. While in 2010, approximately 2.4 billion of world's 6.8 billion people belonged to the consuming class, in 2025 the corresponding figures will be 4.2 billion and 8.1 billion. The size and share of the consuming class will grow. Total consumption will almost double from 2010 to 2025. Globally, education level differences will be decreased.

Geographically, the consumption patterns will continue to differentiate, reflecting the stages of development of the different countries. With the fragmentation of the demand for industrial products continuing, it will be more important for the industrial manufacturers to manage the customisation of the products and services according to the market demand. Knowledge of cultures and local conditions will be increasingly important.

2.3 Technology increases the productivity of the manufacturing industry and shapes operating methods

New technologies are shaping industrial activity. In the foreseeable future, the following interesting development paths will open among others.

The digitalisation trend will continue parallel to electrification; even in the developed countries, it can be said that it is only in the beginning stages. Manufacturing industry, as well, must adapt to the Internet economy and its phenomena. The development of automation and robotics will continue to release the workforce from many low-skill tasks. With the cost of automation declining and its performance improving, the structural change of manufacturing industry continues. The development of robotics is at the threshold of new possibilities.

The so-called *big data* combined with the development of information processing enables new types of business concepts. Digitalisation offers a “vein” to which manufacturing, distribution, design and other activities connect. The management of value chains is going digital. Financial and production planning are interconnected at a global level, and a global competition is ongoing on the management of distribution networks. The world can accommodate a limited number of large actors, as building global systems is expensive.

The development is supported by the increased interconnectivity of machines. For example, the Internet and ubiquitous society form in stages. The possibilities that technological development offers to areas such as health care or education can be outlined. Even at present, the obstacles are not largely related to technology but to the prevalent will of the people.

Production processes change with 3-D printing (*additive manufacturing*), for example, getting more commonplace, enabling product customisation and local manufacturing together with the benefits of mass production. New methods enable modelling and simulating things and phenomena before manufacturing (*advanced design*).

The development of energy technologies is currently decisive. Surprising turns of events in this field are possible. One cannot overemphasise the significance of the availability of reasonably priced energy for the current global economy. The disconnection of environmental and energy questions is not yet in sight.

The industry's skill needs to emphasise high multidisciplinary expertise. McKinsey forecasts a shortage of skilled people. This outlook offers possibilities for Finland, as there will be few leaders of the highest and most diversified competence and competition will be intense.

EU's *Key Enabling Technologies* initiative related to industrial policy includes nanotechnology, new materials technology, micro and nanotechnology, photonics, biotechnology and advanced manufacturing.



2.4 Competitive factors of industrial activities and segment growth outlook

Industrial manufacturing is not a single monolith where the same success and competitive factors apply from one line of business to another. A single remedy is not always right for everyone, even if the national industrial policy were to favour an approach independent of business branches. Even if a fully horizontal, i.e., sector-independent industrial policy were to be reached, the operating logic of the various sectors must still be understood to justify it. And even if a horizontal policy were to be reached, it would, in practice, treat different lines of business in different ways!

The table below classifies industrial sectors according to their central competitive advantage factors. The competitive factors by class vary depending on whether the sector is intensive in research and development, labour, capital or energy. The marketability of the end products, that is, how easy it is to take the end product from the point of manufacture to sale elsewhere will affect the choice of location. Also the density of the value, i.e., price per unit, affects the relative cost of transportation.

McKinsey's five-part division of industrial activity based on competitive advantage factors is one premise for deepening Finnish understanding as well. The prerequisites of the success of our own industry sectors can be better understood when the essence, competitive factors and market demand change trends within the segments and the lines of business within them are understood and compared to our own premises. Thus, it is possible to develop existing industrial competitive factors and possibly even create completely new ones.

Figure 8. The five industrial manufacturing segments according to McKinsey

Line of business group		Characteristics	Examples of line of business
 	Global innovations for local markets	<ul style="list-style-type: none"> Competition based on quality and innovation and great R&D intensity¹ (5–25%) Global trading with part of the components (40–50% of trade²), local assembly and productions 	<ul style="list-style-type: none"> Chemical industry and pharmaceuticals Vehicles, e.g., cars Machines, electrical machines and equipment
	Regional refining industry	<ul style="list-style-type: none"> Low marketability (5–20% of trade²) Very complex and expensive logistics Freshness requirements and local accustomed tastes as the drivers of the need for proximity Relatively automated, low R&D 	<ul style="list-style-type: none"> Rubber and plastic Metal products Food and drinks Printing and publishing
	Energy/resource-intensive commodities	<ul style="list-style-type: none"> Provision of commodity type input to other sectors; generally low marketability Energy and resource-intensive (energy intensity³ 7–15%) Price competition, little specialisation 	<ul style="list-style-type: none"> Wood products Paper and pulp Basic metals Mineral based products Oil refining
	Global technologies/innovators	<ul style="list-style-type: none"> Competition based on R&D and state of the art technology and high T&K content¹ (25–35%) Highly marketability (55–90% of trade²) in both components and end products 	<ul style="list-style-type: none"> Computers and office equipment Semiconductors and electronics Medication, precision mechanics and optical instruments
	Labour-intensive commodities	<ul style="list-style-type: none"> Labour intensity⁴ (30–35 hours for each thousand dollars of value added) Highly susceptible to price competition Global trading (50–70% of trade²), differences in local markets lower 	<ul style="list-style-type: none"> Textiles, clothes and leather Furniture, goldsmith products, toys and other industrial products not classified elsewhere

1) R&D intensity = R&D expenses divided by (nominal) value added, USA, 2007.

2) Significance of the trade = export divided by (nominal) gross income, world, average of 2006–2010.

3) Energy intensity = cost of fuel and electricity procurement divided by (nominal) value added, USA, 2010.

4) Labour-intensity = working hours for each thousand dollars of value added (nominal), EU-15, 2007.

SOURCES: OECD, 2010 Annual Survey of Manufactures, US 2007 Commodity Flow Survey, IHS Global Insight and McKinsey Global Institute analysis

SEGMENT 1. Global innovations for local markets

Segment 1 is comprised of innovation-intensive lines of business whose end products must, however, be customised for local needs. Lines of business in the segment include the chemical industry and manufacture of vehicles, machines, electric machines and devices.

The global production value of this segment in 2010 was approximately 34 % of the value added of manufacturing industry, i.e., USD 3.6 trillion.¹⁶ In this segment, the greatest chunk of gross value (24 %) was added in China.¹⁷

Typically, the segment's production takes place close to the market and the operations require high R&D investment. In addition to R&D-intensity, the chemical industry in particular is typically capital-intensive. A significant part of the production's components are highly marketable. Typically, for example in vehicle manufacturing, certain components are very modular and suitable for several uses. Often complex production and value chains are formed.

¹⁶ Approximately five percent of the world's GDP!

¹⁷ In particular with respect to China, it is always worth asking about the ownership of the manufacturing company (Chinese state-owned, Chinese private or other), as this is very significant for channelling the value. It is known that foreign, often American, companies are in a position to dominate the value chains for high technology products. See for example <http://www.aei.org/papers/economics/international-economy/trade/global-value-chains-and-the-continuing-case-for-free-trade/>.

The proximity of the end demand is a strong driver for this segment. The high cost of transportation will lead the end production to be more easily moved to highly populated countries such as China and India in the future. This offers possibilities for developing countries. The development path is both a threat and a possibility for the developed countries. The threat is the loss of industrial manufacturing jobs, while the possibility is connecting with the value chains of the new, growing markets.

Public policy measures, often defensive by nature, are characteristic for the segment. Local production is favoured and the premises for trading are restricted, for example by setting requirements on quality and safety. Intervention by governments often leads to situations of excess capacity. Subsidy policy, on the other hand, means that public investment in the retention of jobs is significant and requires income transfers from other sectors. In addition to the subsidy policy, the role of the government is emphasised through standards and certification.

With public investments in innovation activities in the centre, it is in the interests of the government to protect and utilise intellectual property rights (IPR). The availability of skilled labour is a central competitive factor.

When describing the trends of the sector, one can for example look into the largest single industrial sector globally, i.e., the automotive industry. In the automotive industry, there is growth particularly in integrating electronics and software production to car manufacturing.

The chemicals industry is the most significant line of business within the segment. Population growth, urbanisation and continuous demand for agricultural products serve as drivers for the chemical industry. The pharmaceutical industry is connected to the new application possibilities in the health sector, such as development of diagnostics.

In the coming years and decades, interesting development will take place in the lines of business within the segment, with new technologies enabling new structures that divide and connect lines of business and sub-lines of business. Service business connects to products and customer-oriented solutions. For example, plenty will be created in connection with machines, electrical products and devices.

Global innovations for local markets are also a central segment for Finland. In particular, owing to the decline of the electronics industry, a very significant part of the value added of our manufacturing industry is formed in the lines of business of this segment. In the future, our expertise and other competitive factors can further be developed. In this segment, in the machinery and metal industries, for example, Finland will concentrate on certain investment-type niche areas. The champion companies will have the potential for global operations. For SMEs, connections with European subcontracting networks are a possibility, if not even a prerequisite for existence.

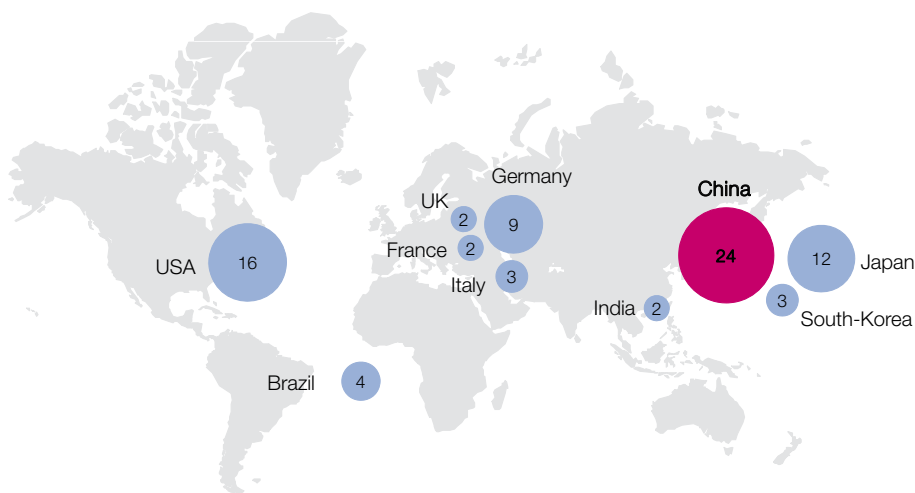
From the policy perspective, it is not wise to select the winning lines of business. It is, however, highly possible that if the aim of the industrial policy is to increase

value added and thus raise the gross domestic product, this segment and its renewal will be important to Finland in the future.

Figure 9. Gross value added of production in the global innovations for local markets segment by country.

In the global innovations for local markets group, China has the greatest value added, while the United States and Japan are second and third (respectively)

The global market shares of the ten largest national economies (based on gross value added), 2010



Note: The calculations take into consideration the 75 largest national economies of the world, 28 of which are advanced and 47 developing. The calculations are based on the estimates of all industrial sectors (excluding D37 recycling) from IHS Global Insight statistics.

SOURCES: IHS Global Insight; McKinsey Global Institute analysis

SEGMENT 2. Regional processing

This segment includes, for example, rubber and plastics production, the manufacture of metal products, the foodstuff and drink industry, the tobacco industry and the manufacture of printed products and publications. The segment's share of the global value formation is 28 %, i.e., USD 3 trillion.

The segment is labour-intensive and has the highest employing effect in the developed countries. The foodstuff sector is also capital-intensive. As the sector generally speaking has low marketability, the price of labour or capital does not largely affect the choice of location. The industries in the segment have very complex and expensive logistics, and the line of business is also largely automated. The research and development contributions in relation to the value added are modest.

Trading obstacles are slowly being eliminated with large producer countries joining the World Trade Organisation (WTO) and bilateral trade agreements. Yet, the foodstuff trade continues to face obstacles and if these obstacles are eliminated within the segment, global trade will increase a little.

As the production takes place close to the demand and the raw materials, the industry is not very concentrated. With a few exceptions (for example powdered

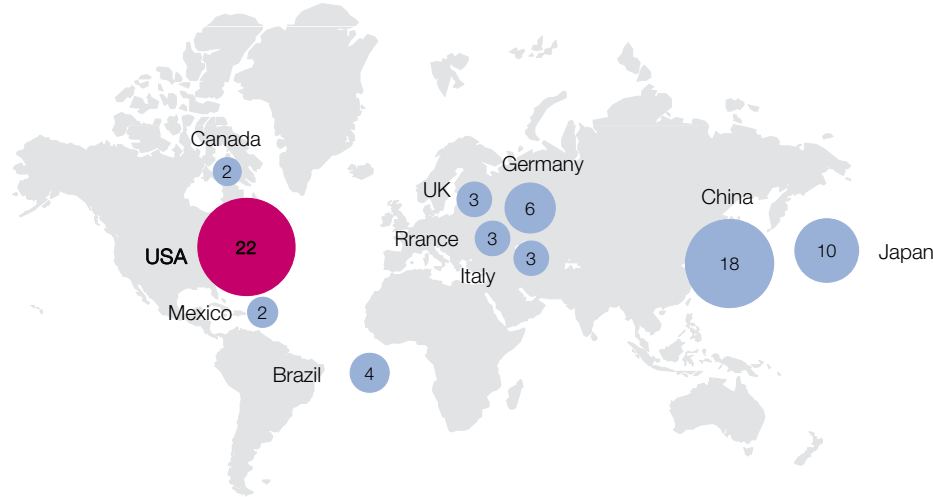
milk), production and sales are close to each other. The requirements for freshness and local taste customs partly promote the requirement of proximity.

Growth potential in the line of business in Finland is weakened by our relatively remote location from the market, although proximity to Russia offers possibilities. From the perspective of overall national economic growth, this segment most likely does not have the same kind of potential for Finland as global, innovation-driven segments. It could be thought, however, that some narrow niche areas could be capable of producing innovative global solutions from Finland. As an example, one can take the utilisation of Finnish wild berries as a brand product with high value added (dried blueberry powder, etc.).

Figure 10. Gross value added of production by country in the regional refining industry segment

The United States and China are leaders in the line of business group of the regional refining industry (both have a share of ~20%)

The global market shares of the ten largest national economies (based on gross value added), 2010
%



Note: The calculations take into consideration the 75 largest national economies of the world, 28 of which are advanced and 47 developing. The calculations are based on the estimates of all industrial sectors (excluding D37 recycling) from IHS Global Insight statistics.

SOURCES: IHS Global Insight; McKinsey Global Institute analysis

SEGMENT 3. Energy-/resource-intensive commodities

The lines of business in this segment include, for example, the manufacture of wood products, the paper and pulp industry, basic metals, mineral-based products and oil refining. The segment's share of the value added worth of industrial manufacturing is 22 %, i.e., USD 2.3 trillion (in 2010).

Within the segment, basic metals (35 %) and oil refining (28 %) have the highest value added. The share of wood products and paper and pulp production of the

segment's value added in total is 18 %. The manufacture of mineral-based products, such as glass, cement and ceramic products, has the highest employing effect (40 %).

The segment's competitive factors are the low cost of transportation and good infrastructure, proximity to demand, raw material resources and the price of energy. The price of labour is significant particularly in the production of wood products. Governments support the lines of business in the segment, for example by investing in research and development activities, granting tax reliefs and imposing import restriction and through other subsidies.

The location of the production is determined by the total effect of the central competitive factors. The optimum location is where energy is cheap, end demand and raw materials exist and the maritime transportation connections are short. The rearrangement of the production is expensive because of the capital-intensive nature. With the growth of the demand in Asia, production has been and continues to be transferred there.

For example, the production of steel and aluminium is often deemed strategically important to a country, as it enables the operation of other lines of business. This can be seen in European discussion when production facilities have had to shut down. China's steel production has benefited from the country's increased demand, and the capacity created in China also includes price competition in Europe.

In particular, the production of aluminium is highly energy-intensive. New capacity has been produced close to low-cost hydropower in Iceland, Russia and China.

The gravity centre of paper and pulp production has shifted to the southern hemisphere, driven by cheap raw materials. The cost of transportation still restricts the marketability, and production aimed at Europeans most likely continues to be close to the continent. For Finland, it is important for the Finnish production units to be competitive at the European level.

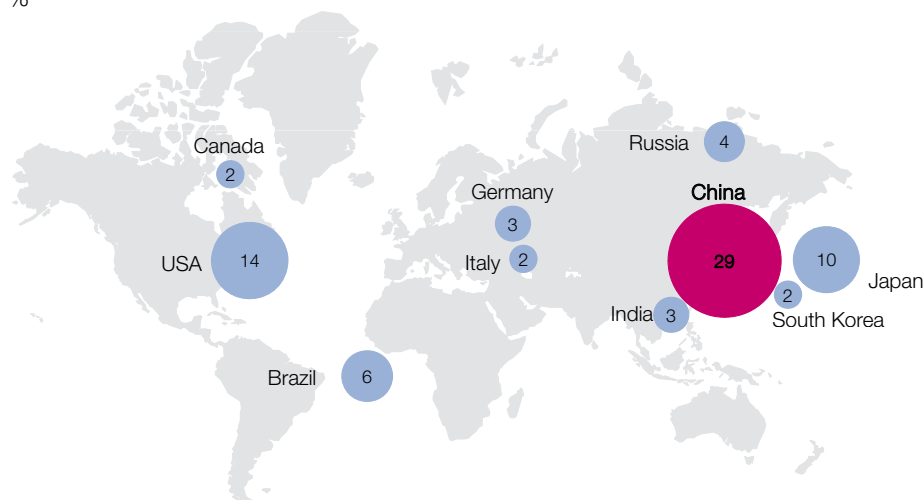
For Finland, this segment is central but not unproblematic from the perspective of sought growth. Plentiful forest resources per capita amount only to a few percentage points of the global forest resources and will not as such provide a significant competitive advantage. However, increasing the value added of bio-raw materials is worthwhile, although one must bear in mind that this technology advantage may not stay with us for long unless the competence can effectively be protected with copyrights. Finland's industrial story is largely based on the forest industry, and the connections and dependencies of other areas of industry with the forest industry should be borne in mind. The forest industry can be seen as a source of a certain kind of resilience in Finland. The price of the wood raw material and the functionality of the wood market are important factors for the forest industry active here.

The increase in the value added of mineral resources should be promoted by all means. The availability of affordable energy is a central competitive factor. On the other hand, developing energy-efficient solutions will create a competitive advantage. New production methods, such as bioleaching can in the future turn out to be significant, as they develop.

Figure 11. Gross value added of production by country in the energy/resource-intensive commodities segment

Developing countries, such as China, Brazil and Russia, are significant national economies in energy/resource-intensive commodities.

The global market shares of the ten largest national economies (based on gross value added), 2010
%



Note: The calculations take into consideration the 75 largest national economies of the world, 28 of which are advanced and 47 developing. The calculations are based on the estimates of all industrial sectors (excluding D37 recycling) from IHS Global Insight statistics.

SOURCES: IHS Global Insight; McKinsey Global Institute analysis

SEGMENT 4. Global technologies/innovators

The global technologies/innovators segment is comprised of lines of business where innovation-intensity is the highest and whose end products are globally marketable.

Industries from the segment include the manufacture of computers, semiconductors and electronics industry products, medical applications, precision instruments and optical devices. The products have high value added and research and development is intensive. The marketability of parts and components is high (products and intermediate products are easy to ship in a shipping container; they are often shipped by air as well). The segment's refining value amounts to 9 % of the global industrial production, i.e., approximately USD 1 trillion.

The central competitive factors of the field comprise innovation on the one hand and low labour costs on the other. The setting appears conflicting but, as one inspects the operating logic of the segment in more detail, it becomes easier to understand what it is about.

In this segment, the global value chains have broken down the fastest and complex value networks have emerged where various competence clusters specialise in very specific niche areas. The value density of the end products is very high (USD 72,000 per tonne for computers and electronics) and the intermediate products are highly modular, i.e., suitable for many uses.

The assembly of the actual end products is often labour-intensive, and installation is concentrated in countries with low cost levels. In addition, the tasks at the end of the distribution chain of electronics manufacturing such as sales and maintenance are labour-intensive, whereby the cost of work is again an important factor.

Electronics and semiconductor technologies have enabled the various forms of digitalisation while other sectors have been utilising the technology. Developed countries have traditionally dominated the development in the field. The American Apple and Hewlett-Packard, Japanese Fujitsu, Toshiba and Hitachi and the European Ericsson, Nokia, Philips and Siemens continue to be the most important companies.

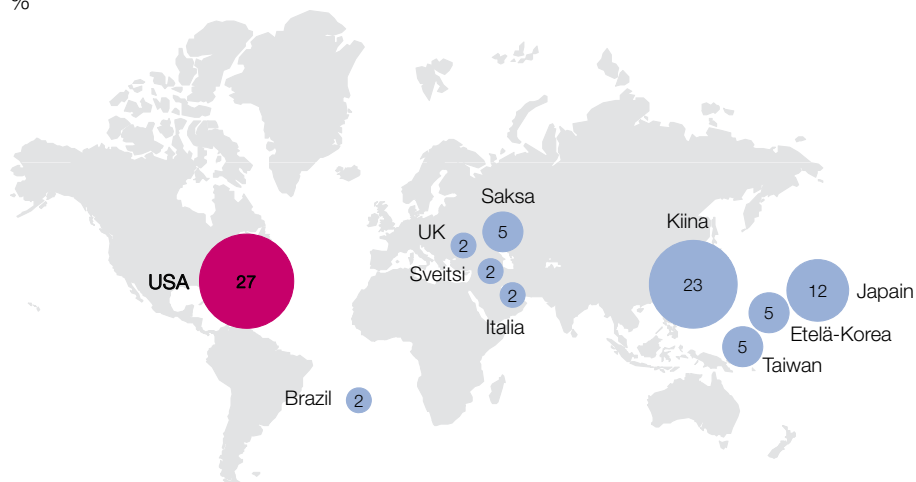
The future of the field will continue to be based on innovations and product development. In the next stage, the greatest profit margins are still likely to be more connected to the utilisation of the possibilities offered by the field as opposed to the technologies themselves. Digitalisation creates new revenue logics.

This segment is important to Finland, and Nokia continues to be a large Finnish company. The outlook of the field was discussed in the ICT 2015 work.¹⁸ The most important thing for us is to continue to participate in the development of the field, as the global lead of innovation activities will continue to progress in the functions of this segment.

Figure 12. Gross value added of production by country of the global technologies/innovators segment

In the global technologies/innovators group, the United States is the largest national economy, with 27% of the global value added

The global market shares of the ten largest national economies (based on gross value added), 2010 %



Note: The calculations take into consideration the 75 largest national economies of the world, 28 of which are advanced and 47 developing. The calculations are based on the estimates of all industrial sectors (excluding D37 recycling) from IHS Global Insight statistics.

SOURCES: IHS Global Insight; McKinsey Global Institute analysis

SEGMENT 5. Labour-intensive tradeables

The fifth and last segment, labour intensive tradeables, represents the labour-dominated commodity industry whose end products are most often globally marketable. Industries in the segment include the textile, clothing and leather industries, along with the manufacture of furniture, jewellery and toys. The segment amounts to only 7 % of the global production value, i.e., USD 700 billion.

The sale of the products is global. In certain situations, for example when the global maritime transportation capacity limit is reached, this segment is the first to give way, which also affects the choice of the production site. Production will move to a place where labour is inexpensive and transportation is reliable. China is the largest manufacturing country but the examples of Italy and Portugal show that even developed industrial countries can have significant manufacturing.

Short manufacturing times and technical skills are competitive factors. The significance of design and innovation is a major competitive factor with high-end products.

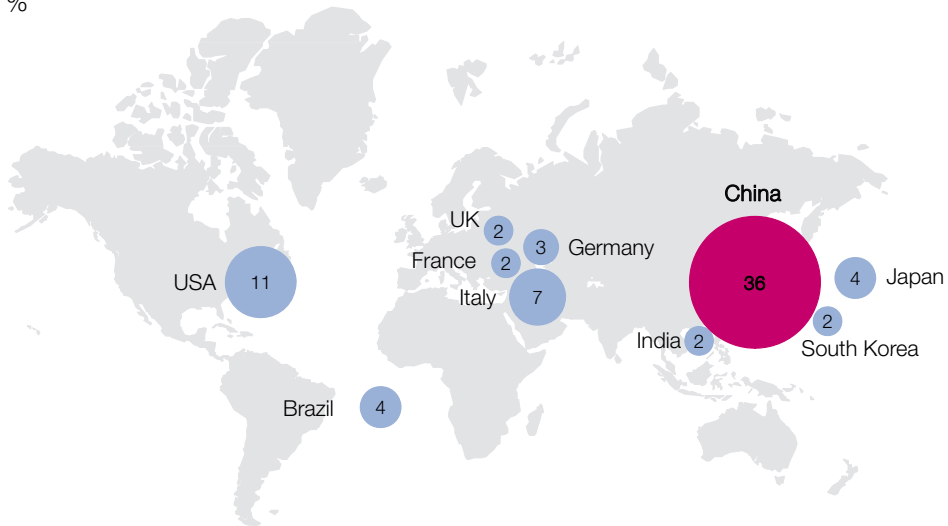
The trade deficits of developed countries are great in this segment and, correspondingly, the trade surplus of the developing countries is significant. There are 24 million workers in China working on tasks in the labour-intensive commodities segment. Changes in the global division of work are usually first seen in the textile industry. It is easy to move sewing machines from one country to another and the first risk-takers will go to countries where the cost of labour is competitive and the operating environment sufficiently stable to ensure undisturbed activities.

For the Finnish manufacturing industry, it is difficult to see significant growth potential for the entire national economy, because we are too expensive of a place for manufacturing, measured by the cost of labour. However, the operating model where the distribution channel is managed and products are made in lower-cost countries is also a possibility for Finnish business.

Figure 13. Gross value added of production by country of the labour-intensive commodities segment

In the labour-intensive commodities segment, China is the leading national economy, amounting to 36% of the global value added

The global market shares of the ten largest national economies (based on gross value added), 2010
%



Note: The calculations take into consideration the 75 largest national economies of the world, 28 of which are advanced and 47 developing. The calculations are based on the estimates of all industrial sectors (excluding D37 recycling) from IHS Global Insight statistics.

SOURCES: IHS Global Insight; McKinsey Global Institute analysis

Below, we will study the present state of Finnish manufacturing industry in more detail from the perspectives of the same five segments. In light of the above, it can, however, be claimed that the potential for expanding the Finnish economy exists specifically in the following segments:

1. Global innovations for local markets (segment 1)
2. Global technologies (segment 4)
3. Resource and energy-intensive commodities (segment 3) with certain reservations

This does not mean that the other segments could not, in individual cases, have growth prospects.

3 The past and present of the Finnish manufacturing industry

3.1 From the rise of industrialisation to the present day

FINLAND'S INDUSTRIAL STORY

Finland's industrial story starts from the forest,¹⁹ although the initial stages of Finland's industrialisation were related to iron refining.²⁰ It can also be observed that the roots of Nokia ultimately stretch deep into Finland's forests.

The productivity rise of the forest industry was based on mechanical industry expertise. This fed the development of forest, paper, pulp and saw equipment. The forest industry, which requires plenty of energy, created the foundation for manufacturing aggregates and generators. The manufacture of aggregates was aimed at the forest cluster and gradually other fields as well. Vehicles, quay cranes, straddle carriers and ships were needed to support the forest industry's logistics. The development of the productivity relied on new machines and devices, which is still evident in the structure of our economy. At present, a significant part of Finland's industrial companies produce investment commodities.

The fine-tuning of the processes through the development of industrial control systems led to the birth of automation and electronics industry. Devices and software that cater to the needs of paper manufacturing were needed. With the regulation on the telecommunication field lifted, visionary and skilled business management could combine Finnish expertise from several fields and create a new global success story, Nokia. In stages, other clusters and skills emerged around the forest cluster core. The roots of the chemical industry can also be found in the forest.

Finland's industrial policy had a long-term mutual connection with the monetary policy. It was easy to restore competitiveness through devaluation, as the raw materials were obtained mostly from the homeland. The world around us has opened up in many ways, and the same economic rules no longer apply. The possibility for devaluation has been excluded in the euro zone.²¹ Now globalisation is breaking down value chains, and local clusters are more easily becoming decentralised into global networks because of efficient communication and transportation technology

19 Teollinen Suomi, Sitra.

20 The beginning of Finland's industrialisation dates back to the Ojamo iron mine, established in 1542. At that time, King Gustav I of Sweden granted Southern Finland's Councillor of State lagman Erik Fleming the right to utilise the ore hill he had discovered in the Ojamo village in Lohja parish in the Raasepori province.

21 The ulterior motives for participating in the common currency may vary, although the monetary policy is shared throughout the euro zone. For example, Germany supports the euro currency, as its central competitors can no longer improve their competitiveness through devaluation. It is worthwhile for Germany to pay a price for its own efficient production system and disciplined financial policy being able to provide it with a competitive advantage in the future as well.

in Finland's key segments as well. Many Finnish industrial actors have already adapted to the trends in many ways. The adaptation still continues.

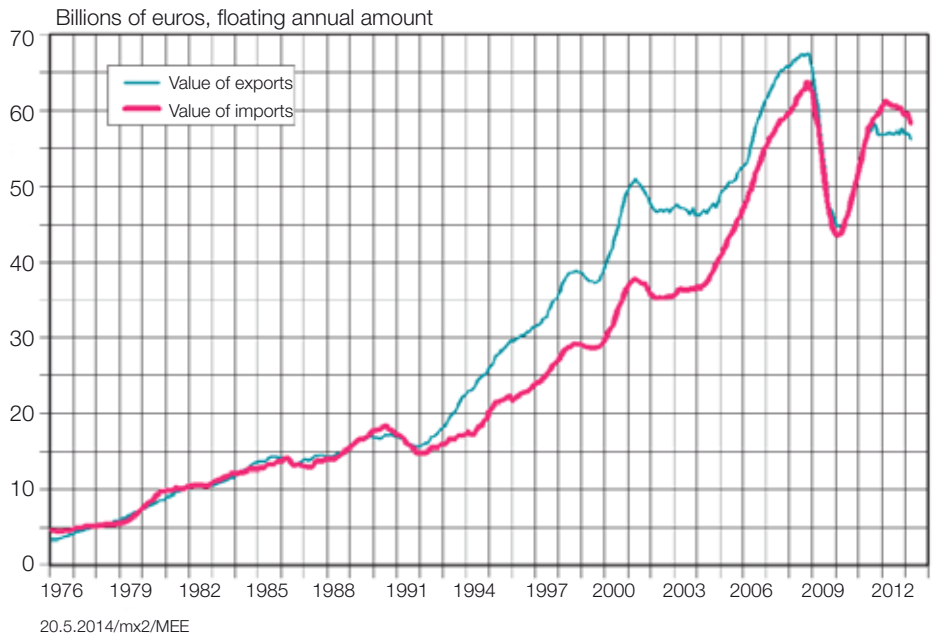
THE STATUS OF FINNISH MANUFACTURING INDUSTRY

The manufacturing industry's operating environment has been challenging for years now. Our export-driven economy has suffered substantial damage, particularly since the financial crisis that erupted in 2008. This has sped up the change related to the global economy, which has been reflected in the operations and success of many Finnish companies.

Bank lending plays an important role in the funding of Finnish companies. With lending decreased and threatening to decrease even further, financial activity has not been able to fully recover.

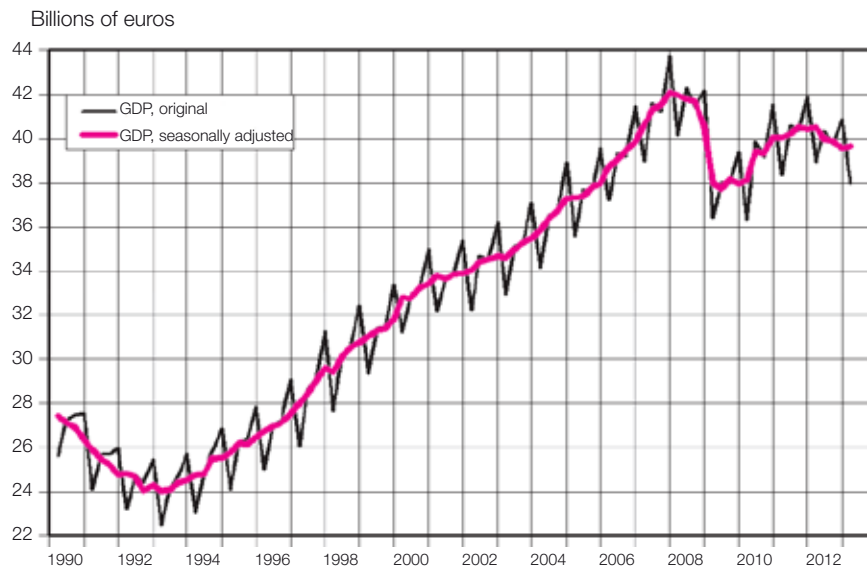
A clear correlation can be observed between industrial exports and the development of the gross domestic product. A saying often repeated in Finland is that when exports are doing well, Finland is doing well. As shown in figures 14 and 15, the connection appears clear. The development of the value of export strongly reflects the development of the gross domestic product volume, and the breakdown of value chains per se does not appear to influence the situation.

Figure 14. Value of goods exports and imports since 1975



Source: National Board of Customs

Figure 15. Development of the gross domestic product volume*



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* by quarter at prices of 2000

Source: Statistics Finland, National accounts

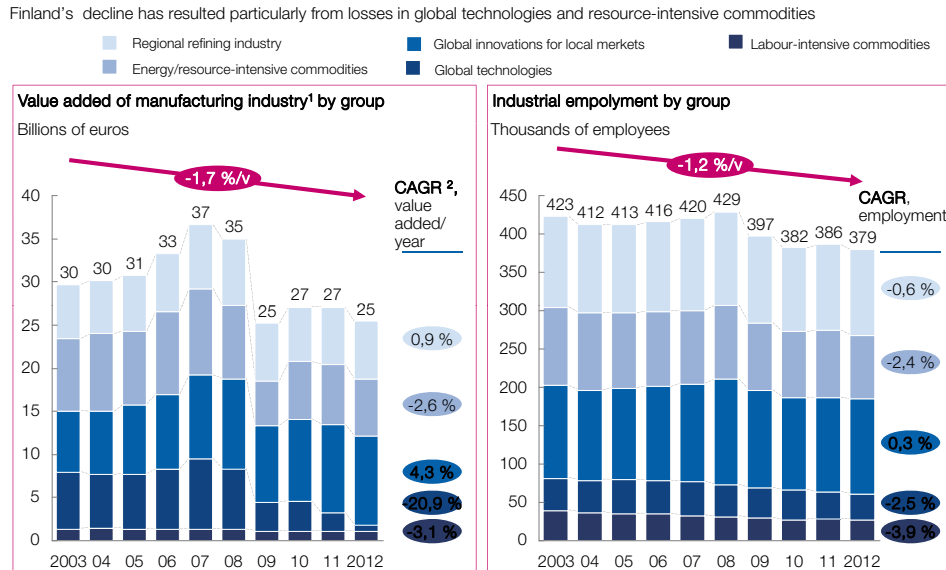
Perhaps a more detailed view can be obtained from inspecting the value added development. During 2003–2012, the value added of Finland's manufacturing industry has decreased by an average of 1.7 % and employment by 1.2 % per year. At the same time, the euro countries on average and the central reference countries in particular, Sweden and Germany, have managed to increase their industrial value added. Finland's decreased value added is explained specifically by the significant drop in the global technologies segment and the decline of resource-intensive commodities, such as the paper industry and metal refining. On Finland's current development path, jobs and the share of the value added have continued to fall (figure 16).

In 2007, the value added of manufacturing class 26 (the manufacture of computer, electronic and optical products, in practice Nokia) rose to EUR 8.6 billion. In 2012, it declined to approximately EUR 400 million. In the corresponding years, the manufacturing industry's total value added worth, i.e., the industry's contribution to the gross domestic product was EUR 35.7 billion and EUR 23.9 billion. In practice, Nokia's success accounts for three-quarters of the decline of the industrial value added. With cascade effects, it also explains a notable part of the development of Finland's GDP (table 2).

One central observation regarding the present state is that regardless of the financial crisis and economic cycles, Finland's success during the days of Nokia's

glory was completely exceptional. Finland was in the profit centre position of Nokia's entire global business. The global success of the company was channelled to Finland to a significant extent. In retrospect, it can be argued that the success of one single company operating in such a volatile field could not remain that strong forever.

Figure 16. Development of industrial value added by segment



SOURCE: Statistics Finland

3.2 Finland's manufacturing industry inspected by segment

The following inspects Finland's industrial fields according to the McKinsey segment division presented above.²² Table 2 describes the development of turnover, value added and personnel by line of business in 2007, 2011 and 2012.

Table 2. Industrial turnover, value added (EUR 1,000) and personnel in 2007, 2011 and 2012 by segment

	Segment		2007	2011	2012
C Manufacturing		Gross value	125,560,677	114,676,462	111,310,396
		Value added	35,685,670	25,221,272	23,554,035
		Labour	381,020	323,899	316,722
19–22 Chemical industry	1	Gross value	17,714,499	21,931,175	21,836,191
		Value added	4,101,144	4,046,871	4,194,934
		Labour	34,614	31,849	31,464
27 Manufacture of electrical equipment	1	Gross value	4,111,919	4,306,354	4,096,258
		Value added	1,219,431	1,226,461	1,262,106
		Labour	15,291	16,320	15,105
28 Manufacture of machinery and equipment n.e.c.	1	Gross value	15,088,037	14,412,173	14,500,786
		Value added	3,742,860	3,949,304	3,826,891
		Labour	48,129	43,947	44,249
29–30 Manufacture of vehicles	1	Gross value	4,060,842	2,618,526	2,850,200
		Value added	927,453	762,487	768,918
		Labour	18,475	14,291	14,440
33 Repair and installation of machinery and equipment	1	Gross value	2,531,314	2,751,992	2,916,771
		Value added	1,147,198	1,107,726	1,135,189
		Labour	19,136	16,608	17,639
10–11 Food industry	2	Gross value	9,590,395	11,191,222	11,589,612
		Value added	2,260,309	2,534,799	2,597,760
		Labour	35,160	33,552	32,952
23 Manufacture of other non-metallic mineral products	2	Gross value	3,288,502	3,041,055	2,965,574
		Value added	1,223,129	1,015,565	969,344
		Labour	16,268	14,138	13,765
25 Manufacture of fabricated metal products, except machinery and equipment	2	Gross value	8,362,062	7,001,135	7,101,358
		Value added	2,997,657	2,346,059	2,420,384
		Labour	45,859	39,333	38,665
24 Manufacture of basic metals	3	Gross value	10,761,068	9,279,036	8,435,546
		Value added	2,351,093	1,203,732	912,019
		Labour	16,149	14,506	14,527
16–17 Forest industry	3	Gross value	22,146,025	19,495,800	18,522,959
		Value added	4,957,035	3,679,720	3,532,824
		Labour	55,139	42,381	39,946
26 Manufacture of computer, electronic and optical products	4	Gross value	22,260,140	14,426,162	12,160,835
		Value added	8,658,380	1,791,864	386,493
		Labour	38,641	28,153	26,268
13–15 Textile, wearing apparel and leather industry	5	Gross value	1,271,894	915,739	1,052,764
		Value added	482,683	376,510	380,017
		Labour	10,135	7,305	7,108
31 Manufacture of furniture	5	Gross value	1,408,462	1,148,283	1,089,842
		Value added	472,119	364,032	354,907
		Labour	9,770	7,681	7,280
32 Other manufacturing	5	Gross value	1,142,038	691,322	724,819
		Value added	441,281	268,115	259,912
		Labour	6,502	4,606	4,484

Source: Statistics Finland

²² In connection with this work, the situation and outlook of the machinery, chemical, forest and electronics industry were inspected in more detail. They will be examined in greater detail below.

SEGMENT 1/Finland. Global innovations for local markets. Mostly the following Finnish lines of business should be included in segment 1, i.e., global innovations for local markets.

- Manufacture of machinery and equipment n.e.c. (TOL 28), value added EUR 3.8 billion
- Manufacture of electrical equipment (TOL 27), value added EUR 1.3 billion
- Manufacture of vehicles and equipment (TOL 29–30), value added EUR 0.8 billion
- Chemical industry (TOL 19–22), value added EUR 4.2 billion at least for most parts²³
- Repair and installation of machinery and equipment (TOL 33), value added EUR 1.1 billion

In total, the value added of these sub-industries amounted to EUR 11.2 billion in 2011.

In the **mechanical industry** (mostly TOL 28), Finland has concentrated on global, cycle-sensitive investment commodities in certain niche fields. Finland is particularly strong in the manufacture of lifting and goods handling machines (Kone, Cargotec, Konecranes), the production of motors and turbines (Wärtsilä) and the manufacture of mining equipment (Outotec, Sandvik, Metso). In these sub-industries significant to Finland, the seven largest companies are responsible for 70 % of the total turnover.²⁴

The turnover of the mechanical industry in 2012 was EUR 14.5 billion, and its share from the value added of the manufacturing industry was 16 %. The large companies in the field are highly international, and more than half of the functions are already outside of Finland.

The activities of SMEs are characterised by subcontracting; approximately 300–400 companies are estimated to have their own products. With the field in Finland dependent on a few large companies, the great challenge is to make new national champion companies emerge. All in all, there are 9,000 companies in the machinery and metal industries, which are mostly very small. There are 1,600 companies employing more than 10 people.

There are but a handful of rising SMEs (in the range of 250–1,000 million euros of turnover): Sandvik, Patria, Andritz, Componenta, Rolls-Royce, John Deere Forestry, Ponsse, Acgo Sisu Power, Siemens. Even in terms of these companies, many are foreign-owned. Because of the high concentration in the field, the economic cycle and company risks are very high from the national economy point of view.

In Finland, the value added of the field is largely (70 %) comprised of employee compensations, i.e., salaries. Important operational surpluses important for future investments have, however, slightly increased.

23 The chemical industry lines of business are all bundled here into segment 1. The calculation in figure 8 divides the sub-industries into different segments in more detail.

24 The Finnish turnover including shares of profit is 70 percent. The estimate is a calculation of the turnover which companies reported to Finland (not the global turnover), including shares of profit from abroad. There are underlying calculations from the data from the Finnish Patent and Registration Office and Statistics Finland, and therefore are not 100% accurate.

The field is challenged by the fragmentation of supply chains that were caused by globalisation. A great number of traditional Finnish subcontracting relationships have been dissolved as Finnish champion companies increasingly procure their parts and subcontracting from outside of Finland. The internationalisation of the SME field and opening of a supply channel would be important for the development of the field. On the other hand, many SMEs are facing a change of generation.

In Finland, 70–80 % of the sales of companies target the slowly growing EU markets. Product development investments have increased significantly but often target gradual development or are merely aimed at sustaining activities. The companies in the field actively work in three SHOK communities (FIMECC, Cleen and Fibic).

Global growth in the field has quickened its pace since the financial crisis. Urbanisation and electrification serve as growth drivers. Finnish manufacturing industry has not completely tapped into this growth and has lost its market shares, falling slightly behind the corresponding industries in other countries.

In the future, growth will be concentrated in Asia. The growth of the demand for lifting machines will rise as construction in China continues. In Europe, growth will result from the need for modernising the machines. The demand for engines and turbines will increase with the progress of increasing electrification of households when the need for backup and adjustment power increases. China's strategic decision to make shipbuilding a national priority also changes the market of engines and turbines. The demand for mining equipment is increased by the rising demand for minerals. The demand for new types of solutions will increase as the excavation concentrations are reduced.

So-called global challenges also serve as growth engines. Energy efficiency, material efficiency and environmental friendliness demand new technological solutions. Cleantech has already been made into an area of development in Finland. Cleantech solutions are often related to the possibilities offered by mechanical technology.

Service business will increase because of the need for maintenance of the equipment in the field and new installations. The service business already produces significant value added for Finnish companies but only adds value to Finland's national economy to a limited extent, as the work is done in the assignment country, often with a local workforce. Innovative solutions could overcome this challenge through new technology (digitalisation, remote readability, 3D printing etc.). This would also contribute to the value of the national economy.

Improving the competitiveness of the field requires increased research, development and innovation investments, raising the automation level of production and directing the development investment toward breakthrough solutions.

The field is in an interesting stage of development and offers plenty of possibilities. Finland has expertise and experience but a certain fragmentation and its small size are problematic. It appears there is demand for programmatic development of the

field as market demand changes and new technologies and business models become more commonplace (Internet economy and industrial Internet, robotics etc.).

The **manufacture of electrical equipment** (27) is an industry with value added of 1.3 billion.

For many parts, observations described above regarding the mechanical industry apply.

The value added of the **manufacture of vehicles** (29–30) was EUR 800 million in Finland in 2012. The value added of ship and boat building was EUR 200 million, of which EUR 70 million was attributable to pleasure boats.

Although the shipbuilding industry has received plenty of publicity, its value added as a field is relatively moderate. The marine industries cluster, however, also covers other industries, such as machinery and electric industry functions. It would be interesting to conduct a study to determine to what extent the Finnish maritime industries cluster is connected to the Finnish shipbuilding industry and to what extent international networking development has increased alongside the clusters. The maritime industry has its own development programme.

One can ask what possibilities Finns have for integrating more broadly in this industry when there is global growth through integrated electronics and software in the automotive industry, for example. On the other hand, with the European Commission proposing broad-scale expansions of the internal markets and research activities of the European defence and security fields, Finland may have new opportunities for further collaboration with large European device suppliers in its own areas of strengths in all of the above fields. With respect to innovation activities, this could mean participating in mission-driven projects and thus transitioning to entirely new technologies for use on the civilian side.

The **chemical industry** (19–22) is one of the few fields that has sustained continuous growth in the past decade. In Finland, the chemical industry is considered to cover chemicals, chemical products, oil refining, pharmaceuticals and pharmaceutical preparations, plastic and rubber products, cosmetics and detergents and other chemical products.^{25, 26} The gross production value of the chemical industry was EUR 21.8 billion in 2012 and the production's value added was EUR 4.2 billion. In 2012, the chemical industry became the largest exporter in Finland.

The **petrochemical field** has the largest turnover, with Neste maintaining the largest share of turnover. The value added of the field is approximately 500 million euros. The activities are guided by a business model based on refining crude oil imported from Russia with highly competitive profit margins. According to this model, value to Finland's national economy would be promoted by basing the supply chain to be based more on Finnish raw material. The demand for traffic fuels is

25 In international comparisons, it should be noted that chemical industry is not commonly considered to include the pharmaceutical industry in Europe; the statistics of this industry are compiled separately.

26 In this review, petrochemicals have been placed in segment 1 together with the rest of the chemical industry although it should, for the sake of accuracy, be placed in segment 3, i.e., resource and energy-intensive industry. The manufacture of rubber and plastic products would, correspondingly, belong to segment 2, regional refining.

rising and environmental regulation emphasises the significance of technological innovations. Predictability of regulations is of primary importance in the field.

The **manufacture of chemical products** in Finland is fragmented. Kemira is the largest with its turnover of 2.2 billion. The value added of chemical products has developed evenly, and employee compensations are the most significant in terms of the value added. Industrial actors increasingly specialise in service and technology solutions instead of product manufacturing. In this development, Finland has not reached the level of the top actors in the world. We have a few large players, though they are small in the international comparison. Population growth and the increased need for agricultural products combined with rising standard of living bring a larger demand for fertilisers and plant protection agents.

As a whole, the value added of the chemical industry grows at a rate of 3 % per year, mostly because of the **pharmaceutical industry**. Finnish companies are small and often fall behind in business comparisons. Yet, R&D investment in the field is in line with corresponding companies in other countries. Measured by turnover, the pharmaceutical industry grows at a rate of 8 % per year in Finland. The largest company is Orion. The share of operating surplus has been significant in the rise of the value added of the pharmaceutical industry.

For the chemical industry, the growth of bio-based raw materials has also been significant. Currently, approximately 20 % of the raw materials are biological. Regulation has a strong effect in the chemical industry's operating environment in Finland, and considering Finland's special conditions is important for the entire nation.

The chemical industry is typically capital-intensive. Thus, one can ask whether it would be possible to lower the capital-intensity requirement and attract new innovative companies and investors in the field by making it easier to commercialise the research results through various development platforms. For Finland, increased collaboration between the chemical and forest industries would be favourable.

Many global challenges require skills in the chemical field. For example, the various production models of agricultural production could be one area of development (*technogarden thinking*). Earth needs solutions for the challenges related to the phosphor, nitrogen and water cycles. It is estimated that the planet will run out of phosphor, needed in the production of food, before oil.

Another possibility is related to system-level changes in health care. Information technology, advanced diagnostics etc. will offer new and even revolutionary solutions in the field of personal healthcare.

In the chemical sector, one can see the need to develop the scattered field in a holistic way. The public sector can help develop and implement testing and piloting platforms. There is no strategic centre for science, technology and innovation (SHOK) in the field of chemical industry.

SEGMENT 2/Finland. Regional processing²⁷

Generally, the following industries can be placed in the regional processing segment:

- Manufacture of food products and beverages (TOL 10–11), value added EUR 2.6 billion
- Manufacture of other non-metallic mineral products (TOL 23), value added EUR 1 billion
- Manufacture of fabricated metal products, except machinery and equipment (TOL 25), value added EUR 2.4 billion

In the **foodstuff industry** (TOL 10–11), the Russian market offers Finland potential for growth. To some extent, global possibilities might open in the form of exporting preserved food and dried products. The **manufacture of other non-metallic mineral products** (TOL 23)²⁸ and the **manufacture of fabricated metal products, except machinery and equipment** (TOL 25)²⁹ will not be discussed as extensively in this study.

SEGMENT 3/Finland. Energy-/resource-intensive commodities³⁰

Commonly, the following Finnish industries can be placed in this segment:

- Forest industry (TOL 16–17), value added EUR 3.5 billion
- Manufacture of basic metals (TOL 24), value added EUR 900 million

The forest industry can be considered the basis of Finland's industrial structure. Attention is paid to the decline of the segment's value added.

The backbone of the **forest industry** (TOL 16–17) is the **paper and pulp industry**, which represents 70 % of the industry's turnover (EUR 18 billion). The forest industry uses pulpwood, sawmill chip, sawdust, log, waste produced during wood refining and harvesting scrap.

There are three Finnish companies among the ten largest paper and pulp companies in the world: UPM, Stora Enso and Metsä Group. As a rule, large companies dominate the chemical forest industry. During the last decade, the industry's value added has declined from EUR 7 billion to EUR 3.4 billion. The shares of profit have decreased and most of the value added is channelled through salaries. Employment has decreased from 68,000 to 45,000.

Globally, the industry is growing but there is almost no growth in Europe or North America. Finland's forest industry has lost its market share to an extent. However,

27 Food, beverage, tobacco, metal refining, printing and publishing, rubber and plastic.

28 231 Manufacture of glass and glass products, 232 Manufacture of refractory products, 233 Manufacture of clay building materials, 234 Manufacture of other porcelain and ceramic products, 235–6 Manufacture of concrete, cement, lime and plaster, 237 Cutting, shaping and finishing of stone

29 251 Manufacture of structural metal products, 252 Manufacture of tanks, reservoirs and containers of metal, 253 Manufacture of steam generators, except central heating hot water boilers, 254 Manufacture of weapons and ammunition, 255 Forging, pressing, stamping and roll-forming of metal; powder metallurgy, 256 Treatment and coating of metals; machining, 257 Manufacture of cutlery, tools and general hardware, 259 Manufacture of other fabricated metal products

30 Basic metal, refined fuel, coal, nuclear fuel, mineral products, paper and pulp and wood products.

the general growth outlook of the forest industry is positive, especially in packaging industry and pulp production.

In the paper industry, the market situation varies but the main market of the industry, European printed paper, still has considerable excess capacity. This is largely the result of the digitalisation of advertising and the decreased demand for printed media. On the other hand, online trade increases the global demand for packaging materials. For cardboard products, there are growth expectations, particularly in developing countries. The production of short-fibred pulp has grown significantly in South America. Global demand for long-fibred softwood pulp has been increasing along with higher demand for packaging materials, soft and special papers and a decreased supply of recycled fibre. The balancing of the market situation for softwood pulp has significantly improved the market outlook of Finland's pulp industry.

At the moment, 70 % of Finland's pulp exports go to Europe. Although the growth expectations are not great, the European market will continue to be significant. Factories in Finland are mostly competitive, and thus excess capacity could be eliminated. Factory conversions are also possible. In particular, the price of wood and the functionality of the wood market are critical success factors.

The **wood product industry** represents 30 % of the industry's turnover. The industry produces timber and construction materials, as well as other wood products. The share of SMEs is significant in the industry. In Europe, the market for wood products is likely to grow when the financial situation improves and construction picks up speed. With its exports to North Africa, Finland's sawmill industry has been able to compensate for the shrinking European demand. China's demand for timber grows rapidly, which is a great opportunity for Finland. To date, the Chinese demand has been met with imports mostly from Canada and Russia. Finland's costly expenses and the high price of the raw material weaken the export possibilities of our timber and wood product industry. In addition, the availability of raw materials has occasionally been a problem for Finland's timber industry.

The **industrial use of biomass** is expected to grow strongly in the future. It is estimated that Europe's demand for biomass will increase by 30 % by 2020. Completely new materials can also be manufactured from wood biomass, such as composites, textiles, nutritional substances, medicines, etc. Refining the biomass into new products with higher value added also opens up significant possibilities for Finland. A closer collaboration between the forest and chemistry industries could speed up the development and commercialisation of new innovations.

In Finland, the forest industry also uses wood to produce renewable energy and electricity. The forest industry produces approximately 70 % of Finland's renewable energy. Finland is a definite forerunner in large-scale combined production of electricity and heat. The small-scale use of wood for energy production is not economically profitable without subsidies. Reaching the profitability limit for energy use would require either stronger regulation/subsidy policy or technology

development (a 40 % decrease of expenses). The utilisation of waste wood and the demand for wood pellets is growing in Europe. Converging wood biomass into liquid bioethanol and biodiesel is becoming commercially profitable from the technological perspective. In 2020, approximately 10 % of the traffic fuels will be bio-based. The products in the industry are globally marketable.

The **manufacture of basic metals** (TOL 24)³¹ is an industry typically close to the market, raw materials and affordable energy. Short maritime transports are possible but long distances limit global marketability.

There are many significant units in coastal localities in Finland, for example in Kokkola, Harjavalta, Raahe, Tornio etc. (Boliden, Rautaruukki, Outokumpu etc.). Recent structural changes in the industry are the result of global market situation changes. The new capacity created in Asia leads to competing products on the market.

The operating programme “Making Finland a leader in the sustainable extractive industry” has initiated 35 measures in the fields of administrative processes, promotion of exports, education, research and international collaboration in order to improve the premises of mining activities. The measures also support the increase of the value added.

SEGMENT 4/Finland. Global technologies/innovators ³²

In Finland, this segment includes the manufacture of computer, electronic and optical products (TOL 26). In 2012, the value added was EUR 400 million but, for example, in 2007 it was approximately EUR 8.7 billion.

In the **manufacture of computer, electronic and optical products** (TOL 26), Nokia dominated Finland’s enterprise field. Nokia’s recent ownership arrangements of network and telephone business have created a new situation, considering the development of the industry.

The value added channelled to Finland through Nokia amounted to a quarter of the entire manufacturing industry’s value added in 2007. Nokia’s story is exceptionally significant in Finnish industrial history, and the competence capital we accrued is great. Finland has been able to hold onto its competitive edge in the industry. Ten companies boast turnover of over EUR 100 million. Their ownership is distributed rather evenly between Finnish and foreign owners. The research and development investment in the industry continues to be EUR 1.8 billion. The industry has plenty of professionals and high-level skills, which also attract foreign companies to Finland.

The digitalisation of societies has been a long-term development. In the same way, digitalisation will continue, transforming into new industries. The electricity and

31 241 Manufacture of basic iron and steel and of ferro-alloys, 242 Manufacture of tubes, pipes, hollow profiles and related fittings, of steel, 243 Manufacture of other products of first processing of steel, 244 Manufacture of basic precious and other non-ferrous metals, 245 Casting of metals, 2451 Casting of iron, 2452 Casting of steel, 2453 Casting of light metals, 2454 Casting of other non-ferrous metals

32 This group includes the semiconductor and electronics industry, treatment equipment (medicine), precision instruments, optics, computers and office equipment.

electronics industry will continue to grow, particularly in the regional of developing countries.

The industry will continue to be volatile, and great market fluctuations will be characteristic. Parallel to device manufacturing, the creation of value will increasingly shift toward software, service and other businesses. In employment in Finland, the focus has also shifted from device manufacturing to the software side (not exactly the manufacturing industry but an essential sector related to the industry).

Nokia's story is an example of one so-called systemic change. Mobile technology enabled an altogether new way of living. In the future, one can assume that this segment will play a significant role in the emergency of new systemic changes. For example, healthcare solutions will change with new technologies and the development of diagnostics and treatment methods.

Considering Finland's industrial continuum, the segment is essential. Practical measures are in progress as part of the framework of the ICT2015 project. ICT competence and the utilisation of the possibilities of the Internet economy horizontally to all industries should become practical in the collaboration (Digile) between the Strategic Centres for Science, Technology and Innovation (SHOKs).

The adaptation of the industry to the Internet economy will continue, and Finland should make use of its own strengths.

SEGMENT 5/Finland. Labour-intensive tradeables.³³

In Finland, this segment includes primarily the following:

- the textiles, wearing apparel and leather industry (TOL 13-15), value added EUR 380 million
- manufacture of furniture (TOL 31), value added EUR 350 million
- other manufacturing (TOL 32), value added EUR 260 million

The **share of the textile industry** of the value added of Finnish production has decreased and is marginal. We have, however, examples of how Finnish industry has shifted **from the manufacturing mode to having products manufactured for it** and has gained markets with its skills in co-ordinating supply and value chains. For example, in the Luhta business model, production takes place abroad but the most important tasks of the value chain are located in Finland.

As a new possibility, we can see the development of operating premises and the abilities of Finnish industries that outsource manufacturing. The programmatic development of business models that includes Finnish design on the clothing industry market or the market of other consumer commodities, for example, could open new growth potential. The experiences of the gaming industry in terms of product scalability could be very useful in this business.

33 Textiles, clothes, leather, furniture, jewellery, toys and others.

3.3 Challenges for the manufacturing industry and Finland's competitiveness

CHALLENGES OF THE BUSINESS FIELD

Manufacturing industry has been the backbone of our business sector. Our manufacturing industry is still the engine of our economy, although it would be desirable for the service business to also produce new cornerstones.

The decline of the industry's value added is at present the most severe problem our manufacturing industry is facing. The problem can also be made positive, as Nokia's value added was so high just a short time ago that it alone channelled EUR 9 billion of value added to Finland. The value added was not largely based on goods exports from Finland but instead value from the head office channelled through various transfer pricing mechanisms. That position has been lost at least for now, and we must seek new sources of growth, on a broader front.

As shown by Nokia's example, centralisation poses significant company risk for a national economy. The turnover of Finland's ten largest industrial companies amounts to 52 % of the gross domestic product. In Sweden, the corresponding share is 34 %, while in Germany it is 29 %. Even without Nokia, the turnover of Finland's ten largest industrial companies would amount to 38 % of the gross domestic product.³⁴

Behind the large companies, Finland's medium-sized enterprises (50–249 employees) promote the manufacturing industry's turnover and exports less than the corresponding companies in Sweden and Germany. In Finland, medium-sized companies are responsible for 14 % of the manufacturing industry's total turnover, while in Sweden the corresponding figure is 21 % and in Germany 18 %. Finland's medium-sized enterprises are significantly less internationalised than their Swedish counterparts. In Finland, medium-sized industrial companies form 9 % of the manufacturing industry's overall exports, while in Sweden the corresponding share is 17 %.

Finland has few medium-sized companies (turnover EUR 250–1,000 million) that could develop into significant large companies in the near future. By comparison, Germany has managed to build a solid Mittelstand segment. A Mittelstand company is typically family-owned and plans the business in the long term. It concentrates on a limited set of products, seeking international leadership in its segment, and is export-centric (approximately 70 % of the turnover comes from exports).

Finland also faces a risk related to the line of business of the largest companies. Lines of business that grow slowly form a large part of Finnish manufacturing industry's value added. In 2012, paper and paper products formed 15 % and metal refining 4 % of the manufacturing industry's total value added. Both fields of industry are expected to grow at most marginally in Western Europe. In addition, regional

34 Here we refer to McKinsey's calculations and estimates.

refining, where the outlook is also modest, forms 26 % of the total value added of Finland's manufacturing industry.

Multinational companies can serve as the orchestrators of value chains. Often they only have competence in intellectual property rights and research and development activities. For Finland, it is very important to have a sufficient number of driving companies that reach the international forefront. At the same time, the essential success factor of smaller companies will be their ability to link with international subcontracting networks.

For exports, Finland also has the country risk. Finland's manufacturing industry is still primarily concentrated on the needs of the developed western countries. In Finland, 70 % of industrial exports and 80 % of business acquisitions involve OECD countries.

Recently experts have said that certain characteristics related to Finnish business culture should be noted. According to international experts, Finnish large companies have been slow to allocate their business to new growth areas, which deteriorates their profitability. Large Finnish large companies have been more flexible in reducing their personnel than in Sweden and Germany. Between 2009 and 2013, the ten largest industrial companies in Finland have reduced their full-time personnel by 12.5 %, while the same figure in Sweden is 11.3 % and in Germany, 2.7 %.

The lack of diversity at the executive level of the large companies is worth noting. This, in turn, may reduce the readiness for change. In Finland, 80 % of the top management of the ten largest industrial companies are Finnish or Swedish and 75 % have a degree in economy or technology/engineering. Women amount to 25 % of board members, and in steering groups the figure is 11 %. The figures may not necessary indicate an ability to reform. However, in principle, greater diversity entails views more propitious for new growth possibilities than a more homogenous composition.

Innovation-centric industries are the most critical to Finland's growth, as there the competitive advantage is determined primarily based on technology and business innovation and not on the cost of labour or manufacturing. The large research and development investment of Finnish companies in telecommunications covers the below-comparison R&D investment in other industries. The R&D investments of industrial companies as a whole form 2.7 % of the GDP in Finland, compared to 2.4 % in Sweden and 1.9 % in Germany. Without telecommunication, the investments of the industrial companies in research and development form 1.2 % of the GDP in Finland, 1.8 % in Sweden and 1.7 % in Germany.

The innovation activity of Finnish industrial companies appears to concentrate on gradual improvements rather than innovations seeking breakthroughs. Annually, a significant number of people graduate with high-level degrees relevant to innovation activities, compared to the reference countries Sweden and Germany. However, in the comparison of economic and technical universities central to innovation activities, Finland is behind the relevant reference countries. Finnish companies have

historically been successful with inventions, i.e., technically significant inventions, but have been less successful at commercialising them.

In order to grow, Finnish companies should be able to produce more breakthrough innovations (disruptive innovation in products, services, processes, business models etc.), turn them into products and sell them on the market. In the short-term, profitable business requirements and the cost-efficiency of processes are emphasised, but in the medium-long term, it is necessary to also seek new openings. In order to succeed, Finland should be able to build new growth on top of its traditional strengths, for example on the forest and chemical industries' biotech and cleantech competence.

The value added produced by service business is often local and makes it difficult to channel the value produced by the companies' international business to Finland. One challenge is thus to also channel value to Finland from the upstream functions of the value chain, i.e., from repair, maintenance, etc.

CHALLENGES FOR COMPETITIVENESS IN THE NATIONAL ECONOMY

Finland is a country of high competence. Investments in education, competence, research and innovations have been sizable. Our university institution is comprehensive and relatively high-level. However, we do not reach the global cutting edge in very many fields.

Finland is also a country of expensive labour. We like to compare our cost of labour to Sweden, Germany and a few other reference countries but, in global comparisons, the cost of industrial work is high.³⁵

Measured by overall tax burden, we are, again, ranked among the top countries despite the fact that it is not very simple to compare countries. Public expenses in proportion to the gross domestic product have risen to 58 %, the highest in the EU. Although the corporate tax base was lowered to 20 %, the high overall tax burden slows the dynamics of the private sector.

The value chain breakdown highlights some fundamental questions regarding our labour market model. With the narrow salary range and the negotiation model inflexible according to international estimates, the threshold for moving manufacturing work to other countries may be lower than it would the other way around.

Boston Consulting Group's study offers a bleak outlook on the manufacturing industry in the Nordic countries, primarily because of the erosion of the price competitiveness. At the same time, it forecasts a brighter future for the U.S. and German manufacturing industries, mostly for the same reasons.

35 According to a study by Boston Consulting Group, the average cost of industrial labour per hour is high in Finland. In the comparison, the average cost in euros per hour was: Norway 34, Finland, Sweden, Denmark 27, Germany 22, France 19, U.S. 16, Eastern Europe 5 and China 2. Revitalizing Nordic Manufacturing. Why Decisive Action Is Needed Now. August 19, 2013 by Andreas Alsén, Ian Colotta, Martin Daniels, Borge Kristoffersen and Pekka Vanne.

The above figures should be considered indicative, as different results have also been presented by the Nordic countries and Germany.

Our energy system is functional and energy is relatively inexpensive. This creates competitiveness in resource-intensive fields (appendix 1). Logistically, we have close maritime connections. Considering the operating premises of the industry, our infrastructure is one of the most stable and functional.

FINLAND AND THE EUROPEAN INTERNAL MARKET

Finland's EU membership (1995) has sought stability and prosperity. The central goals were access to the internal markets without formalities at the border and repeated testing and certification processes for product approval. The goal was to facilitate exports and imports, thus increasing the productivity through intensified competition. In addition to immediately removing obstacles, harmonisation has also had dynamic effects and structures have changed. Companies and areas have specialised. The companies have reached a higher scale for their business, which also creates premises on the competed global market.

The capital markets were integrated after the adoption of the euro. We were not prepared for the shocks of 2008, and after the smooth stage in the beginning, the structural flaws led to deepening crises. It has taken some time to rectify the disparity between the broad-scale adoption of the euro and the incoherence of political instruments, which has been possible only since 2012.

The economic effects in the EU have accumulated. The U.K. and Ireland have attracted plenty of investments from outside the EU, and the cost level of the countries in Eastern Europe remains attractive. The competitiveness of fringe areas, such as Finland, has often not been sufficient to attract investments. In EU's decision-making, it is challenging to take into consideration the effect of all decisions on competitiveness and employment. The consistency of policies still requires strengthening.

The digital internal market has been called the fifth freedom. The growth push could be significant if the current, fragmented situation based on national regulations and their application could be rectified. National experimental markets could serve as a stepping stone toward global success. The U.S. free trade agreement is a significant possibility for the EU and, according to ETLA calculations, it could provide a 0.5% increase for Finland's GDP.

The European Commission has commissioned an estimate (2013) on how much the unrealised internal market restricts the development of productivity and jobs in the EU. The theoretical calculation compared the differences between the most productive country and the average productivity in six sectors that represent 20 % of the entire productivity difference. The sectors were construction, retail trade, legal and advertising services, wholesale, road transports and the hotel and restaurant industry. The identified measures for harmonising the productivity on the markets

would increase productivity in these six sectors by 5 % and the productivity of the entire EU by 1.6 % in the medium-long term.³⁶

The competition policy has had a significant impact on the structure of industries in Finland. The wellness of the buyers of products, ultimately the consumers, has significantly increased. It is estimated that Finnish companies have saved hundreds of millions of euros in lowered financing costs because the financing was obtained from the euro market.³⁷ For Finnish companies, the elimination of the exchange rate risk has provided a significant advantage, which has also benefitted consumers.

36 Study on The Cost of Non-Europe: The Untapped Potential of the European Single Market; BEPA 2013

37 Timo Korkeamäki: The Corporate Benefits of the Euro. Finnish Institute of International Affairs Briefing Paper 103, 2012

4 Steps for renewing Finnish industry

4.1 Economic growth and goal-setting

MANUFACTURING INDUSTRY AND ECONOMIC GROWTH

Economic growth is generated by increasing both work input and work productivity. With the aging population, there is a threat that the amount of work input will decrease in Finland. Another threat is that the publicly financed sector will take a larger part of the work input.³⁸ The number of privately funded jobs was more or less at the same level in the 1970s when the population was 4.7 million instead of the present 5.4 million. Taking care of the amount of work input should be an area of focus in the enterprise policy.

Value is channelled to the national economy mostly through salaries and company profits. Economic growth will occur if transitions to work tasks of higher value added take place. Thus, promoting the productivity of work is another area of focus for enterprise policy. Thirdly, the accumulation of company profits emphasises business competence, and channelling them back into the company is in the interest of each national economy. Only profit shares enable the investments the renewal requires.

The goal of the industrial policy must be to support sustainable economic growth. The success of the industry can be measured by the value added that increases the gross domestic product (see table 2). The primary goal must not be the number of industrial jobs, although the number of industrial jobs, particularly in innovation-dominated segments, correlates closely to the growth of value added. Similarly, the main goal of industrial policy should not be increasing the GDP share of industrial activities. Productivity growth should also be sought in service industries.

The growth potential for the value added of Finnish industry can most likely be found on in the global innovations for local markets and global innovations segments (segments 1 and 4). Finland's naturally plentiful raw material resources and relatively low-cost energy favour the energy and resource-intensive commodities segment (segment 3). The regional refining segment (segment 2) may also have growth potential but the growth strategy for Finland's industry cannot be built primarily on the success of this segment. The growth potential of the nearby areas is not sufficient as a source of significant growth. The same applies to the labour-intensive commodity industry (segment 5), where Finland's cost level is all too high from the perspective of broad-scale production. From the perspective of the service business, this segment could, however, be a source of significant growth.

38 Publicly financed sector, see MEE publication: Industrial Competitiveness Approach. http://www.tem.fi/files/35777/TEMjul_5_2013_web.pdf

For the progress of Finland's industrial story, the above in practice means that the largest industrial activity contribution for the growth of the national economy can be found in the mechanical and metal industry, the manufacture of electrical devices, certain sectors of the chemical industry and the electronics industry. The same applies to sectors of the forest industry insofar as they can reform, increasing their value added. New business functions that cross sector boundaries will develop gradually.

At all times, it must be borne in mind that the manufacturing industry is not the only source of growth! Google, Amazon, Apple and Microsoft are examples of service companies that utilise digitalisation, orchestrate the value chains and enter new lines of business, thanks to their high cash reserves.

The economy will base its efforts on the existing structures. Reform related to creative destruction is highly promoted by start-ups. Yet Finland must also consider the success of its current industrial champions, as it is exactly the multinational companies that are the most affected by the global network economy. The growth and reform capacity of medium-sized actors that follow behind the large ones is similarly of national importance.

AN AMBITIOUS GOAL FOR GROWTH

A realistic but aggressive goal for Finland would be two percent annual growth of industrial value added, which corresponds to the growth rate of the global market in key sectors. Reaching this goal would require that sectors that have grown in Finland faster than in Western Europe (e.g., the mechanical engineering and electronics industry, the innovation-centric global technologies segment) would reach the global growth rate. In other sectors, reaching the growth goal would require that Finland reach the same level as Western Europe. In the longer term, Finland could reach three percent annual growth with the relative weights of the sectors changing to segments that produce more value added.³⁹

Setting the industry back on the growth track would have a significant impact on Finland's economy. If industry were to reach an annual growth rate of 2-3 % instead of the forecasted 1.3 %, this would produce more than EUR 3 billion in additional value added for Finland in 2023. Reaching the 2-3 % growth objective, the total value added of the industry in 2023 would be EUR 35-38, while in the 1.3 % case of the IHS forecast⁴⁰ the total would be EUR 32 billion. Taking into account the economy's cascade effect, reaching the growth objective could produce 60,000-80,000 additional jobs in manufacturing and services in Finland, compared to the baseline of 2023. If the cascade effect is taken into consideration, reaching the growth objective could increase Finland's gross domestic product of 2023 by EUR 5-10 billion compared to the baseline.

³⁹ The assessment is based on calculations of the McKinsey consultant company.

⁴⁰ HIS is a global information company with world-class experts in the pivotal areas shaping today's business landscape: energy, economics, geopolitical risk, sustainability and supply chain management.

The grounds for combining horizontal and selective policies are discussed below in section 4.2. Section 4.3 describes four key transitions that should take place in Finland so that industrial growth could become reality. Section 4.4 describes the process of interactive implementation. Section 4.5 describes the moves with which the industry's reform could be advanced by means of the public government.

4.2 Horizontal and selective industrial policies can be combined

A decision must be made in terms of the industrial policy: will the policy make selective choices for different sectors, technologies or other factors or will horizontal solutions, common to all, be applied?

A particular challenge for small countries is the limited resources. Hence, particularly in the field of education and research but, where applicable, also in other policy areas, choices must be made. The problem of these choices is that no one can accurately predict which companies or sectors will be successful in the future. It is worthwhile for a small country to implement an industrial policy that chooses themes as independent from sectors as possible, with great potential. This way, the choices of areas of focus will not apply to individual companies or even lines of business. It is a matter of cross-section themes that affect almost all lines of business. The choices must continuously be assessed critically.

The choice of the areas of focus should rely at least on the following principles:

1. The focus themes apply to all or almost all the lines of business.
2. Finland has existing or developable competence.
3. The selected focus areas support the general goal-setting of the industrial policy, in practice the growth of the value added.
4. For Finland, it is essential that the focus themes chosen are suitable for a small open economy with a high cost level.

Considering the analyses presented in sections 2 and 3 on the state of the global industry and Finland's industry, we present the following thematic industry policy focus areas for Finland.

1) **Cleantech**

Cleantech is the answer to global environmental and other challenges by means of technology. It involves, for example, energy efficiency, efficiency of material use, development of new materials and reduction of emissions and the environmental load in a broader context. This also includes energy-saving construction and town planning. Although cleantech does not refer to individual sectors, it can be understood in a broad sense to emphasise the technology industry (in particular, the fields of mechanical and metal industry

and the manufacture of electric devices). It is critical for Finland to actively seek new growth possibilities that take global challenges and demand into account, applying Finnish strengths and competence to resolving them. Cleantech value chains reach from mines through metal refining and the metal industry to various device and other products, processes and services. Resource efficiency must be considered all across the value chain.

2) Bio and natural resources economy

Bioeconomy refers to an economy that sustainably relies on renewable natural resources to produce bio-based food, energy, products and services. Bioeconomy is expected to be the new wave of economy after the fossil economy, strengthening the economic development and producing new jobs. The transition to the bioeconomy will reduce the dependence on fossil resources and prevent damage to natural ecosystems. Increasing demand for products, food, energy and water, however, will cause scarcity of natural resources and their increased price. The availability of raw materials and the efficiency of their sustainable use will thus become a new competitive advantage. The world-class expertise of Finnish companies in refining biomasses, our strong industrial foundation and plentiful forest resources whose growth for decades has exceeded the harvested volume provide a good premise for developing our bioeconomy. Innovations, collaboration between sectors and combining various technologies will make Finland a pioneer of the bioeconomy.

In utilising the natural resources, ground resources must be considered on a broad scale, for example, by including mining activities. Biotechnology also offers significant business opportunities to the healthcare business. Finland has unique pioneer factors that can be utilised to not only improve the productivity of the health sector's system but also to create significant new business possibilities.

3) Digitalisation and new production technologies

Digitalisation is breaking through in almost all products and services. Increasingly many products and production devices will interconnect with one another through an Internet of Things. At the same time, devices contain an increasing number of information-producing sensors. Utilisation of the information requires analysis by information technology solutions (so-called big data). Industrial production will increasingly be taken care of by robotics. Robots, the 3-D printing of objects and other technologies will enable the manufacture of increasingly unique products. Factories will become more and more automated and intelligent and will connect to the global Internet economy. According to forecasts, there will be a global shortage of top experts. ICT and

automation also offer new possibilities for reforming business processes in leaps.

These focus areas have one thing in common: the associated products or services can be developed in almost all lines of business. Another shared factor is that they are global growth markets. Demand for products and services based on them will probably rise.

4.3 The four necessary transitions of manufacturing industry

The significant growth of the Finnish manufacturing industry requires success in four so-called transitions.

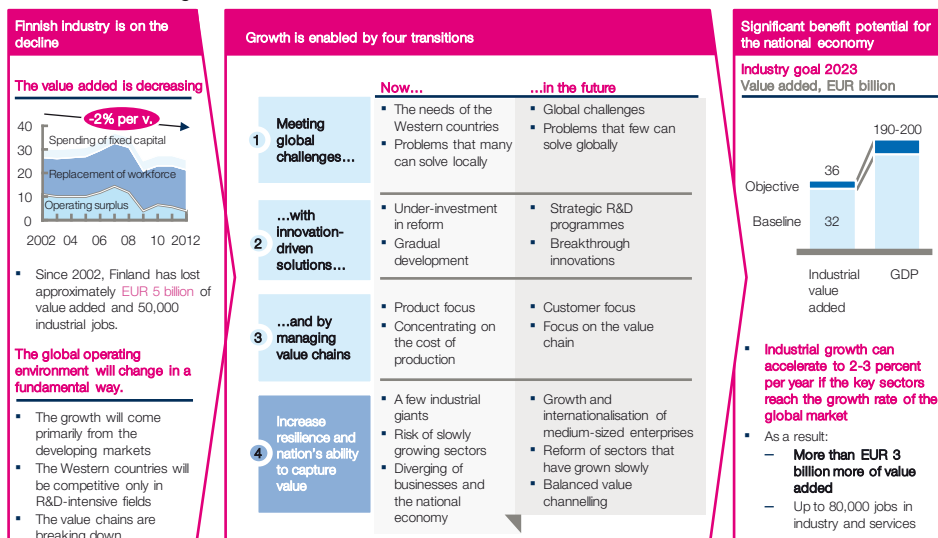
The industry must do the following better than it presently does

1. tap into global challenges and customer needs,
2. build a true competitive advantage from innovations and
3. take control of global value chains.
4. In addition, Finland as a national economy must increase its industrial sustainability and ensure that the value is channelled to the homeland.

Figure 17 illustrates the state of Finland's industry, its target state and the four transitions.

Figure 17. Current and target state of the Finnish manufacturing industry and the transitions that enable the reform.

Finnish manufacturing industry can grow by meeting global challenges, competing with innovation and by managing global value chains. As a national economy, Finland must also increase its industrial sustainability and see to the channelling of the value to Finland



4.3.1 Meeting global challenges

The growth of the developing markets increasingly shifts the focus of the economy to the rising economies while the Western growth rate remains slow. In order to grow, Finnish companies must be able to go from fulfilling the needs of the traditional developed countries to addressing global challenges and market needs. Finland's industrial companies should aim to solve problems that only the best innovators can solve.

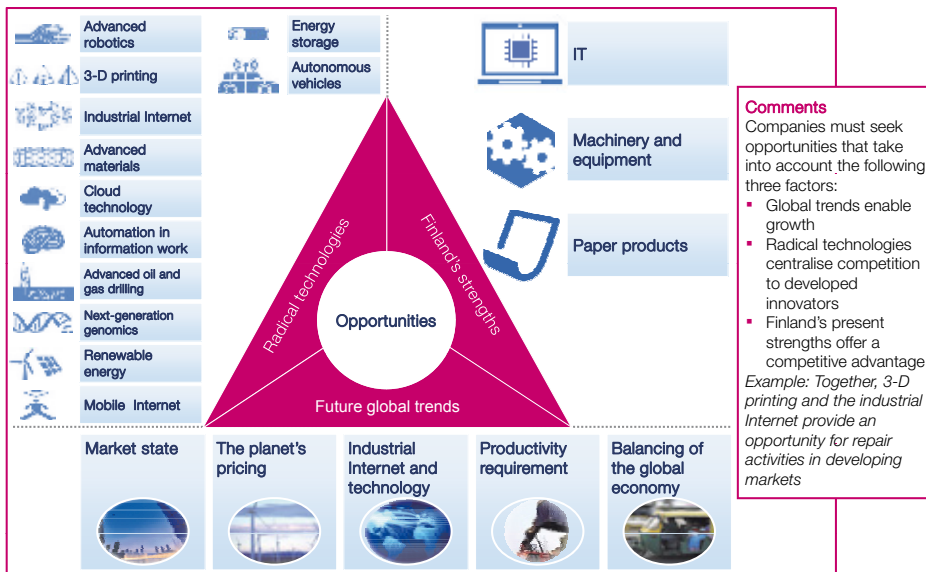
McKinsey's international study shows that the long-term profit to owners of companies is directly proportional to the reallocation level of financial investments. In order to reform, companies should find growth potential in areas that combine the following three factors (figure 18):

1. Global trends create rapid growth of demand.
2. Breakthrough technologies concentrate competition into high competence level companies.
3. Finland's existing strengths provide a competitive advantage.

Improving market knowledge and awareness plays a key role when taking advantage of global growth opportunities, particularly in the internationalisation of SMEs. It is also essential to increase Finnish companies' capacity to reform, particularly by ensuring sufficient competence and diversity on corporate boards of directors.

Figure 18. Finnish industry's "growth triangle"

Company decision makers should concentrate on opportunities to combine global trends with new technologies and Finland's strengths



SOURCE: McKinsey Global Institute

4.3.2 Competitive advantage from innovations

It is only realistic for Finland to grow in the manufacturing industry on the global market in innovation-centric sectors. Strategies based on the cost of labour, raw materials or proximity of the market are not realistic alternatives for Finland with the exception of wood fibre, water and possibly certain minerals. Therefore, Finnish companies must invest in reform. Although Finland is in the lead in several sectors based on research and development contribution indicators, Finland's overall investment is lower than that of the comparison except in the telecommunication sector. For reform, it is essential to have solid development portfolios.

In order to grow, Finnish companies should be able to produce more breakthrough innovations (radical innovation in products, services, processes, business models etc.), then turn them into products and sell them on the market. In the short term, gradual improvement is important but it should be possible to find also new openings in the medium and long term. In order to succeed, Finland should expand on its traditional strengths, for example, the biotech and cleantech competences of the forest and chemical industries.

For the growth of the manufacturing industry, it is essential to ensure that Finland has the premises required for innovation. The public government and industry have several ways of ensuring this. A sufficient level of research and development investments must be secured in comparison to the growth objectives. Allocating investments to the right targets is important.

It has also been recommended that the boards and management of Finnish companies pay more attention to reviewing their innovation strategies and research and development portfolios. The majority of public R&D financing should be aimed at innovations that target new breakthroughs. The related financing criteria should also be clarified at the same time. The public sector should initiate a dialogue with the key industrial companies on allocating Finland's strengths in order to seize global opportunities.

4.3.3 Value chain management

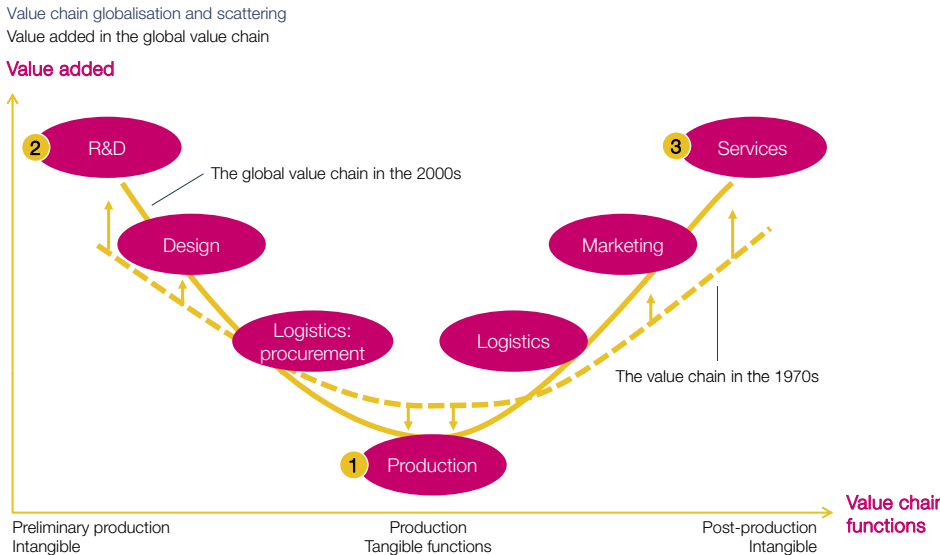
The industry's value chains have continued to break down. Building solutions that can be delivered to the customer in a sustainable way requires the ability to manage a global network of suppliers and partners and to take one's share of the value added thus produced (figure 19). In this environment, it is essentially important for Finnish companies to shift the focus from the product to the value produced for the customer, such as the measurable financial benefit generated for a business customer. Likewise, it is important to focus not on one's own general and production costs but on the entire production chain's costs and the management of the value created in the production chain.

The management of global value chains is a vital ability of industrial companies when the parts of the value chain are scattered geographically and concentrated on increasingly small special areas. This trend will continue to be emphasised in the innovation-centric industries that have a key position for Finland.

Globally, a large part of the successful companies concentrate on value chain management without owning many of its parts or by only focusing on parts where it has an essential competitive advantage. For large Finnish industrial companies, it is also central to be positioned at the managers of the value chain so that they can collect a share of the value produced in the different sub-areas of the global value chains.

At the same time, the competence base of Finnish companies must be strengthened in the management of value chains through education and information, as well as the mobility of competence. Education must ensure the continuous improvement and integration of commercial and technical programmes, building solid competence for global strategy and operations management, and the availability of cultural and linguistic competences aiming at efficient interaction and continuous learning. For information and competence mobility, mobility between internationally successful large companies and other industrial companies must be ensured.

Figure 19. The deepening “smile” of the value chain



SOURCE: OECD, based on Shih (1992), Dedrick and Kraemer (1999) and Baldwin (2012).

4.3.4 Industrial resilience and the channeling of value

STRENGTHENING OF THE COMPANY POOL

As a national economy, Finland is particularly dependent on a small number of large companies, and a significant part of our value added comes from a few slow-growing sectors. In order to increase the diversity of the company structure and to reduce the risk entailed in the success of major individual companies, and to promote industrial growth, it is of vital importance for Finland to secure the premises for the growth of medium-sized companies through active ownership and direct internationalisation support.

There are approximately 120 medium-sized companies with a turnover of EUR 100–500 million in Finland (appendix 2). In the promotion of active ownership, it is important to ensure favourable conditions for capital investments in medium-sized companies. This is a proven method that increases the growth rate of medium-sized companies and has brought them more experienced and international board members and management. Correspondingly, listing on a stock exchange must become a more attractive alternative for medium-sized companies to gather capital for financing growth.

Tapping into the global market can be a lifeline for small and medium-sized enterprises, as the procurements of large Finnish companies are increasingly global. The public sector should support the internationalisation of small and medium-sized companies by gathering relevant market information and promoting the collaboration and networking of medium-sized enterprises in order to offer a sufficiently broad selection for the international B2B market.

REDUCING THE SECTOR VULNERABILITY

Companies operating in slow-growth sectors should reinvent themselves in order to tap into the growth either through growth segments or by differentiating from the competition.

Finland must apply the EU policy actively to ensure that companies utilising Finland's key production input on the internal market have what they need to reform their operations. In particular, regulation targeting bio-based raw materials must be monitored to avoid any unfortunate surprises for Finland and to ensure sufficient adjustment periods, if necessary.

BENEFIT OF INNOVATIONS TO FINLAND

The increased mobility of business capital and profits has resulted in different levels of success for businesses and national economies. Because of the long distance to the market and their product-centric offerings, the investments of Finnish companies have been concentrated close to the end market and in areas with low production costs.

The free movement of capital, in turn, has forced open economies to lower their corporate tax rates. The different regulations in different countries allow companies to channel their foreign profits to countries with low taxation. The procedure enables the postponing of taxation for as long as the company keeps its profit abroad. Similarly, differing transfer price rules for intellectual property rights allow the companies to transfer their profits to areas with favourable tax conditions.

The state must ensure that the benefits of Finnish innovation are channelled into Finland. The public sector must support efficient and broad-scale utilisation of Finnish intangible capital. For example, a better utilisation of VTT's patent portfolio is possible for Finland. The connection of the IPR policy with the growth opportunities for industrial activities must be pursued actively. At the same time, it is necessary to ensure that the interests of countries such as Finland will be taken into account in international decision-making such as that of the European Patent Office and in intellectual property rights matters in trade agreements negotiated by the European Union.

CHANNELLING VALUE FROM ABROAD

With the reduction of factory jobs, Finland's role in global value chains is changing. Developed economies such as that of Finland will remain a viable location of production for complex and high-skill production. Increased quality requirements, increasing automation of production processes and the increase of the cost of labour and often insufficient protection of intellectual property in low-cost countries have increased the attractiveness of advanced economies as the choice of location for complex production. In the future, a central interest for national economy will be channelling the value added into the gross domestic product. Central value-channelling paths are salaries and fees paid for work contributions and the profits of companies.

The industry's value added depends on the location of high added-value investments and work contribution in Finland. Finland must continue to attract foreign R&D and other investments by seeing to the development of the competence capital of the leading research institutions. At the same time, it is essential to ensure that financial incentives for investments will be competitive.

The public sector should promote, where possible, the generalisation of new business forms that channel value added to Finland, such as remote service businesses. This would enable the management and operation of global services from Finland.

For the national economy, it is important for value to be channelled into Finland by means of transfer pricing and other means. For the companies, it is important that Finland is a competitive and attractive place to operate in and show profit. It must be ensured that both become a reality.

For the reform of the economy and development of competitiveness, it is also important to develop new operation methods and products in Finland. An atmosphere

of willingness to experiment will attract inventors, investors, demanding consumers, research institutions and pioneer companies. The ability to reform is also affected by regulation and the framework set by the permit procedures and obligations related to commercial activity.

4.4 Interactive implementation

Reforming the industry requires interaction between the public and private sectors. The best effectiveness is attained if enough parties work in the same direction. The reforming industry requires a new approach from companies, organisations, ministries, public financial institutions, universities, research institutions, Strategic Centres for Science, Technology and Innovation, regional actors, etc. At the same time, finding the key to new success requires new collaboration models.

Processes must be tuned to address Finland's strengths and global challenges while allowing, technologies and solution models to be developed, productised and sold.

The goal of intensifying the dialogue on industry reform is free-form and confidential discussions that

- involves the leaders of reform and other companies from different sectors and size categories;
- creates a roadmap for reform, follows its implementation and supplements it where necessary;
- anticipates challenges and possibilities on the global market and in the homeland operating environment; and
- removes obstacles for growth and aims to improve national competitiveness.

The core of the dialogue could be formed by the reform pioneer companies and the central ministries that are responsible for the operating premises. The dialogue provides the pioneer companies with the possibility of relaying views on global development trends, customer needs and business challenges to public actors. For the public actors, it offers the possibility to deepen understanding on the realities of companies and test the development thoughts for the operating environment.

The leaders of the dialogue are the Ministry of Employment and the Economy (for example the minister, permanent secretary or department secretary) and one of Finland's more advanced industrial companies (managing director). The organisation of the practical work is the responsibility of a core team consisting of the key ministries and companies with the greatest desire for reform.

The broader circle of the dialogue is formed by workshops concentrating on sector-specific special questions and global possibilities. Sector-specific discussions are carried out between actors in the field and the public sector, as necessary. Discussions regarding global possibilities gather together all sectors and their central public actors. The discussions promote cross-boundary collaboration,

practical new openings between companies and initiatives for strengthening the operating environment.

Leaders of the strategic dialogue regularly report to the Economic Council appointed by the government on the state of industry in Finland, global threats and possibilities, implementation of the operating programme and new proposals for actions. Agile implementation means that

- the premise for all measures is the real needs of businesses and the value added produced for them;
- ambitious goals are set for the roadmap that provide a clear direction for common action;
- practical measures have parties with clear responsibilities and adjustments are made to the measures where needed (quick trials, etc.); and
- the common doing is co-ordinated in strategic dialogue. The implementation is monitored based on jointly agreed indicators.

The Ministry of Employment and the Economy must, at the same time, further guide the industry towards reform by using its existing tools in a more coordinated manner to implement the above goals.

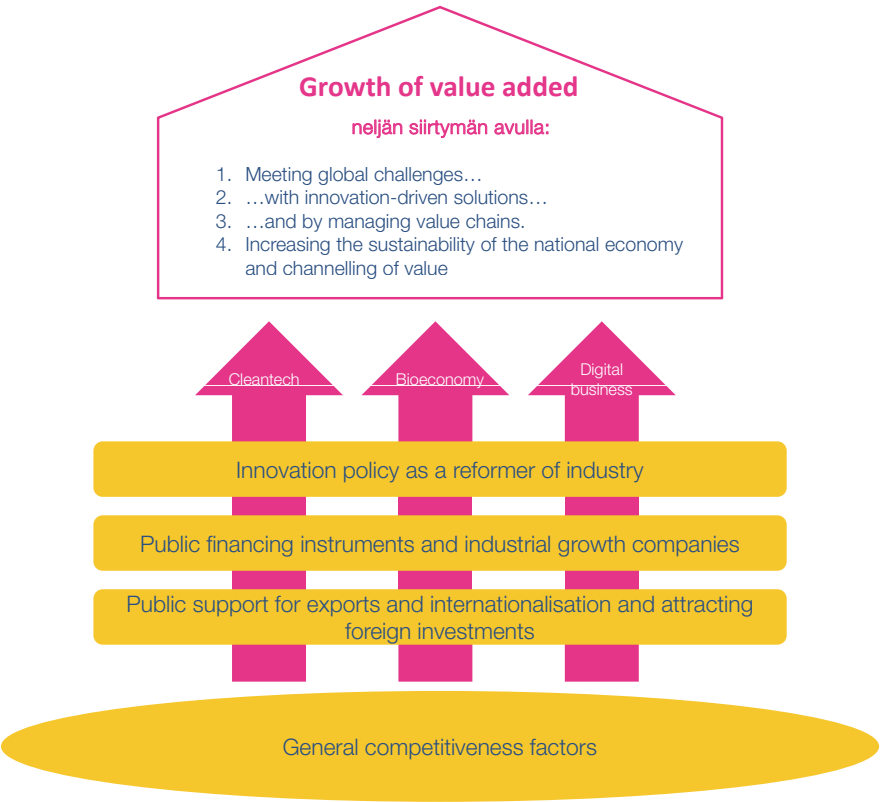
4.5 Public measures and policy lines that promote the increase of the industry's value added

Section 4.3 above describes the transitions that promote reform and which should happen in Finland's manufacturing industry in order for growth-oriented reform to be possible. Below, we describe the possibilities that government has to support the implementation of the transitions in more practical terms (figure 20).

Among others, the public government has at its disposal the education, research and innovation policies, financing instruments and a toolkit for promoting exports and internationalisation. In addition, a toolkit for promoting general competitiveness that covers practically all policy areas of the public government is available.

Thematic choices of focus areas can be used to strengthen the existing relative advantages of Finns and the emergence of new relative advantages in focus areas expected to have the requisites for global growth and in which Finland is considered strong.

Figure 20. Public measures for increasing the manufacturing industry's value added through four transitions:



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Price and availability of energy

Finnish industry has traditionally been very energy-intensive (forest, paper, metal and chemical industry). These sectors continue to form a large part of the volume of Finnish industry. The availability and cost of energy have a significant impact on the operating conditions of energy-intensive industry. The effect of the cost of energy is further emphasised by the fact that the products of energy-intensive industries are often also exportable products, and thus the price of energy also affects the country's export competitiveness, current account and the economic growth of the sectors in question.

Finland's energy-intensive fields, the forest, metal and chemical industry, have been the driving forces of our country's economy for decades. The relative significance of energy-intensive industries has decreased in recent years but they continue to be irreplaceable in Finland's economy. In addition, with the emergence of new industrial production, the average energy intensity of industry is also decreased, though Finland's heavy, energy-intensive industry is far from disappearing from the country. Thus, it will continue to play a significant role as a user of energy and as an employer in the future.

In 2012, the energy-intensive industry's share of the export income was approximately one-third. It employed 85,000 people directly and, when the cascade effect is taken into account, significantly more. The importance of metal refining and the forest industry is further emphasised, when analysing the balance of Finland's current account. In both sectors, most of the production is exported, and a significant amount of raw materials used for production is Finnish. An excellent example of this is the Tornio steel mine combine.

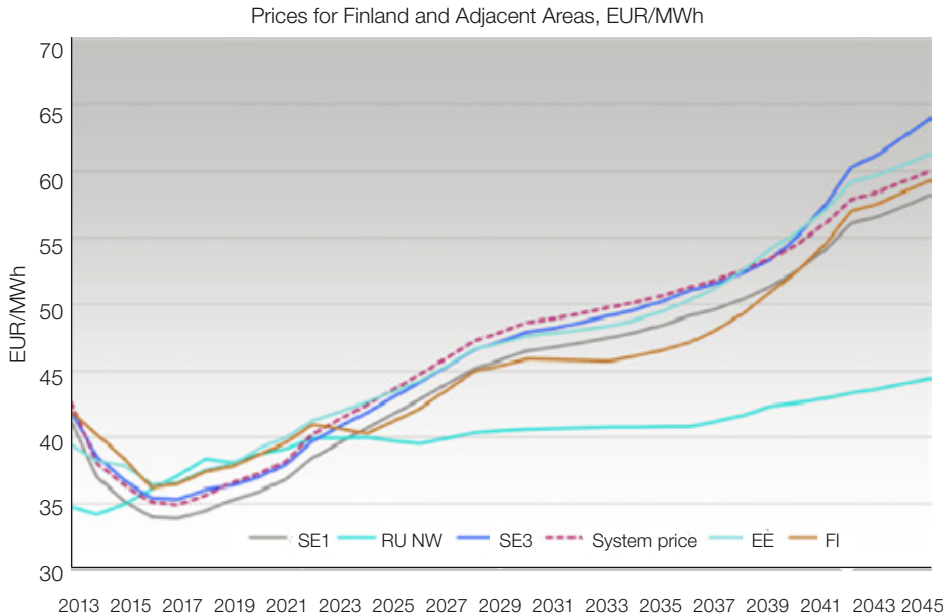
Owing to the significance of the energy-intensive industry for Finland, the significance of energy for competitiveness has been known for some time, and various measures have been taken to try to secure the competitiveness of companies. Attempts have been made to restrict the rise of the industry's energy expenses through the free distribution of emission rights and taxation for energy that is lower than on other sectors. The manufacturing industry has an electric energy tax rate lower than the service sector and households, in addition to which the energy-intensive industry also has a so-called energy tax cutter. This is used for cutting off and returning the majority of energy taxes in the most energy-intensive industries.

There are no foreseeable problems with respect to the availability of energy. Under normal conditions, oil and coal are available at global market prices. The availability risk for natural gas is reduced once the current plans for import terminal projects for liquid natural gas (LNG) have been implemented. At that time, Finland will no longer be relying on a single import route. To date, there have been no problems regarding the availability of natural gas. With respect to electricity, Finland currently

has strong transfer connections with the neighbouring countries, and electricity is transferred between them according to the market situation. With the contributions related to the nuclear power plant projects in the works and renewable energy, the availability of electricity is not expected to be a problem.

With regard to the price of energy, the greatest uncertainty is related to the price of electricity. In Finland, industries that uses plenty of energy obtain their electricity at least partly according to the so-called Mankala principle, i.e., they own the production capacity themselves and receive the electricity they need (or part of it) at cost. The cost of electricity production is prone to a risk resulting from the implementation of the climate policy and emission rights in particular. On the other hand, the more electricity is produced using renewable energy sources, the lower the risk related to the price of emission rights.

The SKM Market Predictor's report (The Nordic and Baltic Power Market Analysis 2013–2045) presents forecasts for the price evolution of electricity. According to the adjacent figure, the price of electricity will rise modestly in Finland and will, starting in the 2020s, be even lower than the Nord Pool system price. The price is rather competitive compared to Swedish regional prices.



Appendix 2

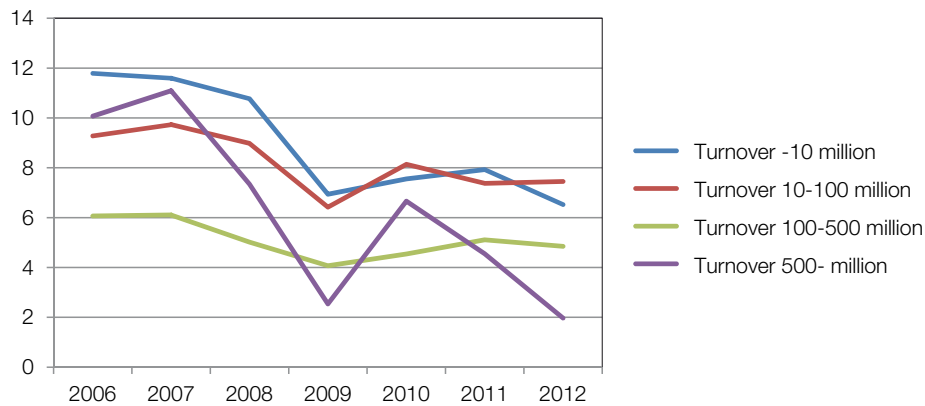
Number of industrial companies, their personnel, turnover and profitability

Table 1. Industrial companies by turnover

Number of industrial companies	Change										
	2006	2007	2008	2009	2010	2011	2012	2006/12	2009/12	2009/12	2009/12
All	22,781	23,231	23,290	22,506	21,951	21,851	21,485	-1,296	-1,021	-1,021	-1,021
Turnover <10 million	21,822	22,183	22,204	21,619	21,041	20,877	20,490	-1,332	-1,129	-1,129	-1,129
Turnover 10–100 million	810	885	926	761	770	824	841	31	80	80	80
Turnover 100–500 million	122	132	130	104	114	118	121	-1	17	17	17
Turnover >500 million	27	31	30	22	26	32	33	6	11	11	11
Industry personnel (full-time equivalent)	2006	2007	2008	2009	2010	2011	2012	2006/12	2009/12	2009/12	2009/12
All	388,701	386,833	381,407	345,987	330,742	330,662	323,123	-65,578	-22,864	-22,864	-22,864
Turnover <10 million	106,970	105,216	100,696	100,302	94,232	94,113	90,590	-16,380	-9,712	-9,712	-9,712
Turnover 10–100 million	110,811	115,767	114,552	104,993	97,016	95,915	95,260	-15,551	-9,733	-9,733	-9,733
Turnover 100–500 million	73,445	70,971	73,156	60,515	61,473	67,007	65,662	-7,783	5,147	5,147	5,147
Turnover >500 million	97,475	94,879	93,003	80,177	78,022	73,626	71,612	-25,863	-8,565	-8,565	-8,565
Industry turnover	2006	2007	2008	2009	2010	2011	2012	2006/12	2009/12	2009/12	2009/12
All	136,288	145,967	150,035	114,612	123,352	132,148	132,329	-3,959	17,717	17,717	17,717
Turnover <10 million	13,492	14,176	14,178	13,062	12,621	13,417	13,463	-29	401	401	401
Turnover 10–100 million	23,814	25,857	26,146	21,705	21,847	23,797	23,910	96	2,206	2,206	2,206
Turnover 100–500 million	22,709	24,099	25,274	20,547	22,554	23,530	23,143	434	2,596	2,596	2,596
Turnover >500 million.	76,273	81,835	84,437	59,299	66,329	71,403	71,812	-4,460	12,514	12,514	12,514

Source: Statistics Finland

Figure 1. The development of the manufacturing industry's operating profit in the various turnover categories.



Source: Statistics Finland.

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Tiivistelmä Referat Abstract			
Raportti tarkastelee Suomen teollisuuden kasvuhakuisen uusiutumisen edellytyksiä ja julkisen vallan keinoja edesauttaa uudistumista. Raportin ensimmäisessä osassa tarkastellaan globaaleja valmistavaa teollisuutta koskettavia muutostrendejä. Erityisesti huomio kiinnittyy globaalien arvoketjujen pilkkoutumiskehityksen vaikutuksiin kansantalouden bruttokansantuotteen muodostumisessa. Tavaraviennillä on tärkeä rooli, mutta vientitoiminta ei enää ole ainoa väylä linkittyä kansainväliseen vaihdantaan. Arvoa kanavoituu kansantalouteen globaalissa verkostotaloudessa myös muita reittejä pitkin. Toisessa osassa tarkastellaan Suomen teollisuuden tilannetta. Teollisen arvonlisan hiipuminen on tämän hetken haasteistamme merkittävin. Teollisuuden työpaikkojen väheneminen ei ole sekään ongelmatonta, mutta silti paremmin linjassa muiden kehittyvien maiden kehityksen kanssa. Kolmannessa osassa etsitään Suomen teollisuuden kasvuhakuisen uudistumisen lähtökohtia. Suomen vahvuudet ovat toisaalta luonnonvaroihin perustuvassa resurssi-intensiivisessä teollisuudessa mutta erityisesti osaamiseen perustuvassa innovaatiointensiivisessä teollisuudessa. Uusia mahdollisuuksia avautuu, jos osaamisemme avulla pääsemme innovatiivisilla ratkaisilla paremmin kiinni globaaleihin haasteisiin ja asiakastarpeisiin. Yrityksille on entistä tärkeämpää kyetä hallitsemaan koko arvoketjua, sillä valmistus on vain arvoketjun yksi osa. Samalla Suomen kansantaloutena tulisi lisätä teollista kestävyyyttään niin, että meille nousee uusia kansainväliseen toimintaan kykeneviä teollisia yrityksiä. Kun yritysten ja kansantalouksien intressit eriytyvät, on tärkeää varmistaa, että Suomi saa kansantaloutena osansa syntyvästä jalostusarvosta. Julkisen vallan on erityisesti huolehdittava yleisistä kilpailukykyedellytyksistä. Se voi kuitenkin olla osaltaan mukana myös tukemassa teollisuuden kasvuhakuista uudistumista erityisesti innovaatiopolitiikan keinoin. Myös mm. rahoitusmarkkinoiden kehittämisellä ja viennin ja kansainvälistymisen edistämisellä on mahdollista tukea teollisuuden uudistumista. Valtio voi myös haastaa elinkeinoelämää vuoropuheluun kanssaan teollisen kasvun ja uudistumisen suunnasta ja edellytyksistä.			
Työ- ja elinkeinoministeriössä yhdyshenkilöt: Elinkeino- ja innovaatio-osasto/Martti Myllylä, puh. 029 50 48034, Tapio Virkkunen, puh. 029 50 60077, Lauri Ala-Opas, puh. 029 50 47156			
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Industrin som en del av en livskraftig näringsstruktur. Globala industritrender, läget inom finländsk industri och stegmärken för den förnybara industrin i Finland			
Tiivistelmä Referat Abstract			
Rapporten granskar förutsättningarna för en tillväxtorienterad förnyelse av den finländska industrin och samhällets medel att främja förnyelsen. I den första delen av rapporten granskas de globala förändringstrender som berör den tillverkande industrin. Särskild uppmärksamhet ägnas åt konsekvenserna av värdekedjornas tilltagande splittring för bruttonationalproduktens utveckling. Varuexporten spelar en viktig roll, men exportverksamhet är inte längre den enda länken till internationellt utbyte. Inom den globala nätverksekonomin kanaliseras värde till samhällsekonomin också på andra vägar. I den andra delen granskas läget inom finländsk industri. Att det industriella mervärdet tynar är den viktigaste av våra trender just nu. Inte heller det att industriarbetsplatserna minskar är oproblematiskt, men det ligger ändå bättre i linje med utvecklingen i andra tillväxtländer. I den tredje delen söker man efter utgångspunkter för en tillväxtorienterad förnyelse av den finländska industrin. Finlands styrkor ligger å ena sidan i en resursintensiv industri baserad på naturresurser men å andra sidan i en innovationsintensiv industri som baserar sig på kunskap och kompetens. Nya möjligheter öppnas om vi med hjälp av vår kompetens bättre kan bemöta de globala utmaningarna och kundbehoven. För företagen är det viktigare än förut att kunna behärska hela värdekedjan, eftersom tillverkning endast är en del av kedjan. Samtidigt bör Finland som samhällsekonomi öka sin industriella hållbarhet så att det hos oss uppstår nya industriella företag som är kapabla till internationell verksamhet. När företagens och samhällsekonomiernas intressen går isär, är det viktigt att Finland som samhällsekonomi får sin andel av det förädlingsvärde som skapas. Statsmakten ska särskilt sörja för de allmänna förutsättningarna för konkurrenskraft. Staten kan dock även bidra till att stödja en tillväxtorienterad förnyelse av industrin, speciellt med innovationspolitiska medel. Också genom att bl.a. utveckla finansieringsmarknaden och främja export och internationalisering är det möjligt att stödja industrins förnyelse. Staten kan också utmana näringslivet till dialog om riktningen och förutsättningarna för den industriella tillväxten och förnyelsen.			
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Manufacturing as part of a vital enterprise structure

This report assesses the prerequisites for a growth-oriented renewal of Finnish manufacturing industries and the role of public policy to promote this.

In the first part of the report global trends affecting the change of the operational environment are evaluated. Attention is especially paid to the splintering of global value chains and the effect of this development to the national GDP formation.

In the second part of the report the overall situation of Finnish manufacturing industries is assessed. The diminishing of industrial value added is the most significant challenge at the moment.

In the third part new premises for a growth-oriented renewal are sought and the possibilities of public policy to promote this development are evaluated.

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