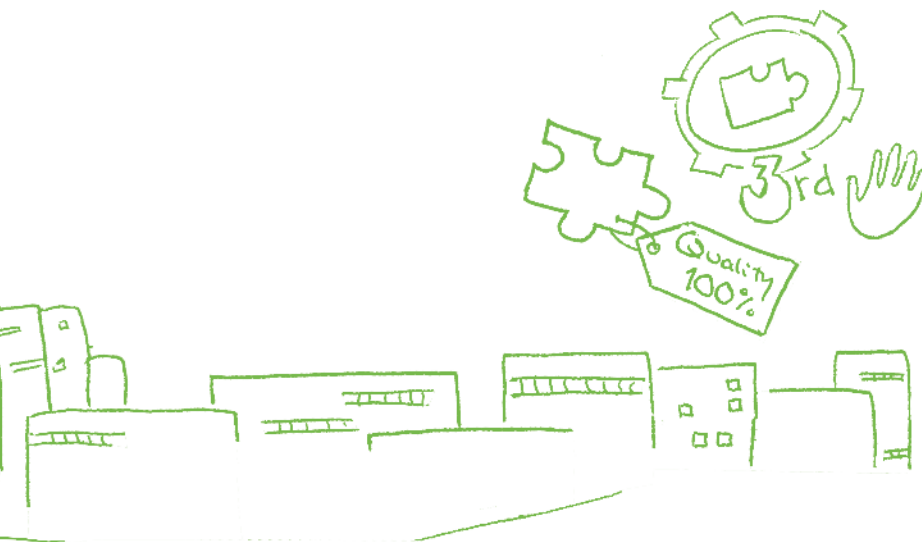






VTT For Industry

Successful business at Finnish manufacturing companies beyond 2020 – Four scenarios



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Foreword

At the beginning of 2015, VTT Technical Research Centre of Finland Ltd launched a four-years spearhead programme called **For Industry** aimed at boosting the competitiveness of the Finnish manufacturing industry. The programme focuses on key technologies that would make new solutions available for Finnish industry to maintain domestic manufacturing as well as to create new products and services for international markets. These key technologies include industrial Internet, additive manufacturing, automation, robotics and embedded intelligence.

In addition to technology, For Industry focuses on how to create successful business from new technology. These considerations include studies on business ecosystems, business models and decision making in complex business environments. Special emphasis in the For Industry programme is given to increasing the competitiveness of Finnish manufacturing SMEs.

One of the key activities of the For Industry programme, in 2015, was to conduct a foresight study on ways for Finnish manufacturing SMEs to conduct successful business, beyond 2020. Executive managers of the programme, Vice President (Research), Erja Turunen and Business Develop-

ment Manager, Risto Kuivanen, set up a project with a project manager, Principal Scientist Jaakko Paasi, and a key researcher, Senior Scientist, Nina Wessberg. The foresight study would be done in collaboration with VTT's experts and representatives of manufacturing SMEs to gain a broad perspective for the visions of the study. This report summarizes the main results of that study.

The main authors of the report would like to thank the following persons for their valuable contributions to the study: Risto Kuivanen for guidance throughout the study; Merja Sippola and Timo Salmi for critical comments on the early results and manuscript of the study as well as on the study's workshops; Riitta Molarius and Joonas Tuovinen for writing early drafts for two scenario worlds, Heidi Auvinen for the visualization of the scenarios and for other artwork for the report.

We are especially thankful for the following representatives of SMEs and interest groups for their insights and contributions to the scenarios: Harri Jokinen (Nomet Oy), Juhani Pohjus (General Finland), Kari Sorjonen (Tasowheel Group Oy), Jyrki Auer (MTC Flextek Oy), Pasi Kannisto (SKS Toijala Works Oy), Reijo Karppinen (Dynaset Oy), Antti Kontiainen (ATA Gears Oy), Ismo Korhonen



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Rauno Heinonen, Juha Kortelainen, Jani-Mikael Kuusisto, Jyrki Poikkimäki, Anne-Christine Ritschkoff, Iiro Salkari, Magnus Simons, Jouko Suokas and Erja Turunen.

Tampere, December 14, 2015

Jaakko Paasi and Nina Wessberg

Executive summary

The main target of this VTT Visions report is to provide guidance to the manufacturing small and medium sized enterprises (SME) in preparing for the future. The report is based on a foresight process conducted at VTT Technological Research Centre of Finland Ltd. during 2015. The process was in connection with VTT's spearhead programme called For industry and aimed to increase the competitiveness of Finnish manufacturing SMEs.

The future target year in this foresight study was 2025. The questions that guided the process were: What will be the potential radical changes? What will be the future markets (i.e. business opportunities) for Finnish manufacturing SMEs? What kinds of products will probably be needed? What kinds of business models will create success?

The foresight process was participatory with the future described in four scenarios, created in a total of five key workshops. The workshop participants were managers and researchers at VTT and entrepreneurs and managers of manufacturing SMEs.

A literature study was conducted before the workshops to set the basis for the scenarios. The studied literature consists of Finnish and international foresight reports, outlooks and articles, mainly related to manufacturing industry. The study identified key factors that will shape the future, the key factors including megatrends creating pressure to change the current system with institutions and power relationships as well as new technologies or other factors which may disrupt the current system and enable the change.

Based on the literature, the most important key

factors could be synthesised into two word-pairs, global-local and growth-scarcity, which were used as scenario coordinates. Hence, the scenarios created were:

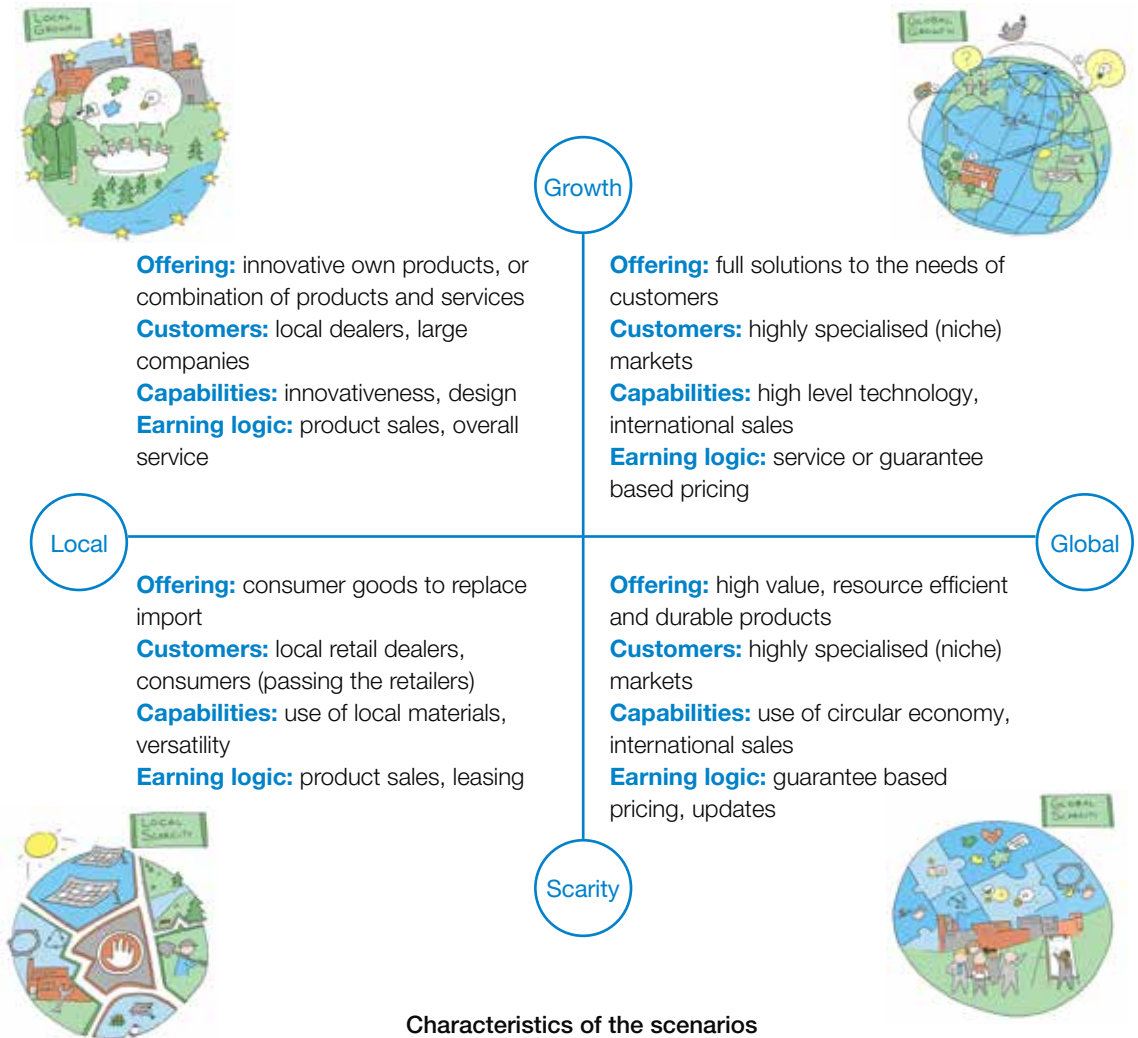
1. Global - growth
2. Local - growth
3. Global - scarcity
4. Local - scarcity

The global scenarios describe future worlds of free trade where value chains are global and competition is extremely strong. Manufacturing SMEs can be successful in highly specialised (niche) markets. Service or some kind of guarantee based pricing model may form the dominant earning logic in the markets.

In the local scenarios Northern Europe or the EU form the business area for Finnish SMEs. The difference between the local growth and scarcity worlds is that in local growth, local business is voluntary driven by customer preferences while in local scarcity it is more or less forced due to borders between countries or unions. Replacement of import is an important business driver for manufacturing companies in the local scenarios.

In the growth scenarios, business is driven by economic growth and the good buying power of consumers. The focus of business is on specialised customer needs. Innovations and high levels of technological competence are important factors of success.

In the scarcity scenarios, scarcity of some critical raw materials and components is the key driver



of business. In global scarcity, raw materials would be available but they are very expensive. In local scarcity, manufacturing suffers from restrictions of raw material import. The use of local materials is important in the scarcity scenarios.

Special characteristics of the scenario worlds and how to be successful in the future world are shown in the figure below. To sum-up, all of the

described four scenario worlds would offer potential for Finnish manufacturing SMEs to conduct successful business, but the models of successful business may not be the same in the different scenarios. Furthermore, the transition from the present regime into a new one in a future scenario may be a fast process. Therefore, companies should be prepared for the future.

1. Introduction

Manufacturing industry has, in a global sense, enjoyed a long era of growth. It has provided the machinery, tools, and materials to build modern infrastructures, transportation and housing. It has produced goods to help the daily life of citizens, etc. Manufacturing has always also included a range of activities in addition to production, such as different kind of services.

Over the past decades, the manufacturing ecosystem has globalized. Design, sourcing of materials and components, and the manufacturing of products takes place more and more often in global value chains. Also, markets for the products have become global. There are a number of factors behind globalization, including changes in geopolitical relations between countries and unions, internet and the widespread growth of digital information, bilateral and multilateral trade agreements, etc.

As a result of the globalization and growth, people around the world are used to taking global growth as a self-evident scenario of the future. Most foresight reports that consider the future of manufacturing take global operations and the continuation of economic growth as the starting point of their future studies without considering alternative scenarios. At the same time, however, a series of changes in the environment creates uncertainty: consequences of climate change, large catastrophic events, wars, etc. What if global growth will not be the driver in the manufacturing industry in the next decade(s)?

From a technology standpoint, we are, in all likelihood, currently in the centre of the fastest

revolution that the industrialised world has even seen: the digital revolution. Digitalization will to some extent shape all activities within societies. In the manufacturing industry, it means new ways to design products and manufacturing, operationalising manufacturing, new forms of intelligence (such as big data and the Internet of things), etc. Digitalization also will affect the business processes of the industry. We foresee drastic changes in the logistic business value chain from a manufacturer to end-users and consumers. eBusiness is already here. What else will come?

What has been written above suggests that we should be prepared for the future and potential, even with radical changes in the business environment. In the manufacturing industry, we have been used to fairly slow changes in technologies and markets, but that situation may change. We may well foresee disruptive changes both in technologies and markets as well as material and workforce resources within the next few years.

In order to support Finnish manufacturing industry in preparing for the future, VTT has done a scenario work under its For Industry spearhead programme. **The target of the work was to develop scenarios for future ways of doing successful business at Finnish manufacturing companies.** A special emphasis was given to SMEs. The target year of scenarios was set to 2025. Questions that guided the work were: What will be the potential radical changes? Which kind of business models would create success? What will be the future markets (i.e. business opportunities) for Finnish

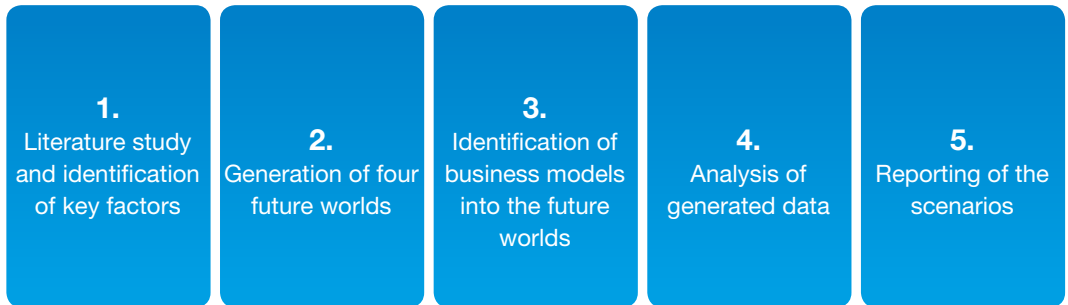


Figure 1. Process of the For Industry scenario work

manufacturing SMEs? What kinds of products will probably be needed?

The scenario work was conducted during a 9 month period in 2015, by using the methodology of participatory foresight. The foresight process was divided into five phases:

1. Literature study and identification of key factors
2. Generation of four future worlds
3. Identification of business models into the future worlds
4. Analysis of generated data
5. Reporting the scenarios

In Phase 1, recent foreign and domestic foresight reports for the manufacturing industry were studied and key factors of the sector were identified and analysed. In Phase 2, four scenario preforms for alternative futures were generated. This work was based on the results of Phase 1. These scenario preforms were further developed in Phase 3 by identifying potential business models in the four different future worlds. The scenarios preforms were completed in Phase 4, where the generated data was analysed. This report forms the main

contribution of Phase 5.

In total, 37 persons were involved in this future study, and it is worth mentioning that of the 37 persons, 11 were representatives of manufacturing SMEs (entrepreneurs, CEOs, other executives). SME involvement was particularly strong in Phase 3 *Identification of business models in the future worlds*, where the SME representatives actually drove the work with researchers being in facilitating and supporting roles. Consequently, the business environment analysis and business opportunity identification in the scenarios of the work are rooted in the viewpoints of SME entrepreneurs and CEOs in the manufacturing industry.

A list of the persons in the workshops of the participatory foresight study and their role in the study are given in Annex 1.

This report is structured as following: In Chapter 2 we report key factors shaping the future identified from the literature study. Chapter 3 presents the four scenarios. In Chapter 4 discussions are given on the concept “How to be successful in the future worlds” Finally, conclusions are given in Chapter 5.

2. Key factors shaping the future

A set of recent foreign and a few domestic foresight reports for manufacturing industry were studied, see Annex II. From these studies, we sought key factors that, according to most of the studies, will shape the future of manufacturing. As a result, a number of key factors were identified. These key factors are set out in Figure 2.

Figure 2 describes the key factors and the framework of this study in a multi-level perspective model, where society is divided into three levels: landscape, regime, and niche. The model is applied from the original work by Foxon et al.¹. We have implemented the possibility of alternative (and partially overlapping) future worlds (scenarios) into the original model. The levels and their contents are described below.

Landscape encompasses the level of big societal moves, such as climate change or aging. In the context of manufacturing, a materialistic way of living, for instance, ensures the demand of products. Also, population growth increases the need for products from manufacturing industry, especially in developing countries. At the same time, the scarcity of non-renewable natural resources as well as targets to diminish effects of climate change will create challenges for the manufacturing industry. Climate change may also give rise to natural disasters with negative implications on the economy. Energy efficiency and renewable energy business will play important roles in the future. Urbanisation will increase the meaning of megacities and the construction

industry. These are examples of megatrends that will shape the future.

Regime describes the system with its actors, institutes, resources, processes and ways of operating. Regime can be divided into physical resources and processes; intangible resources; and political, regulative and market aspects.

Regime states whether the manufacturing is happening in global or local value chains by using global or local resources. For example, in the current regime the design of products may take place in global value chains, but the manufacturing of heavy products is often local. On the other hand, light and low-cost mass produced products can be transported around the world for global markets. The same applies for the manufacturing of very innovative high-end products. There may be areas that have specialised in one kind of production, while others focus on another type of manufacturing.

Infrastructure and its performance are important elements of regime. Intangible resources encompass, for instance, skilled, cost efficient and innovative labour, which is seen in the literature as one of the key issues in creating the success of the manufacturing industry in the future. In markets, it will be important to react quickly to changes in market needs. Moreover, cyber security, as well as security in general, are foreseen to be essential elements of successful business making.

Niche is for issues that may challenge and shape the present regime in a disruptive manner.

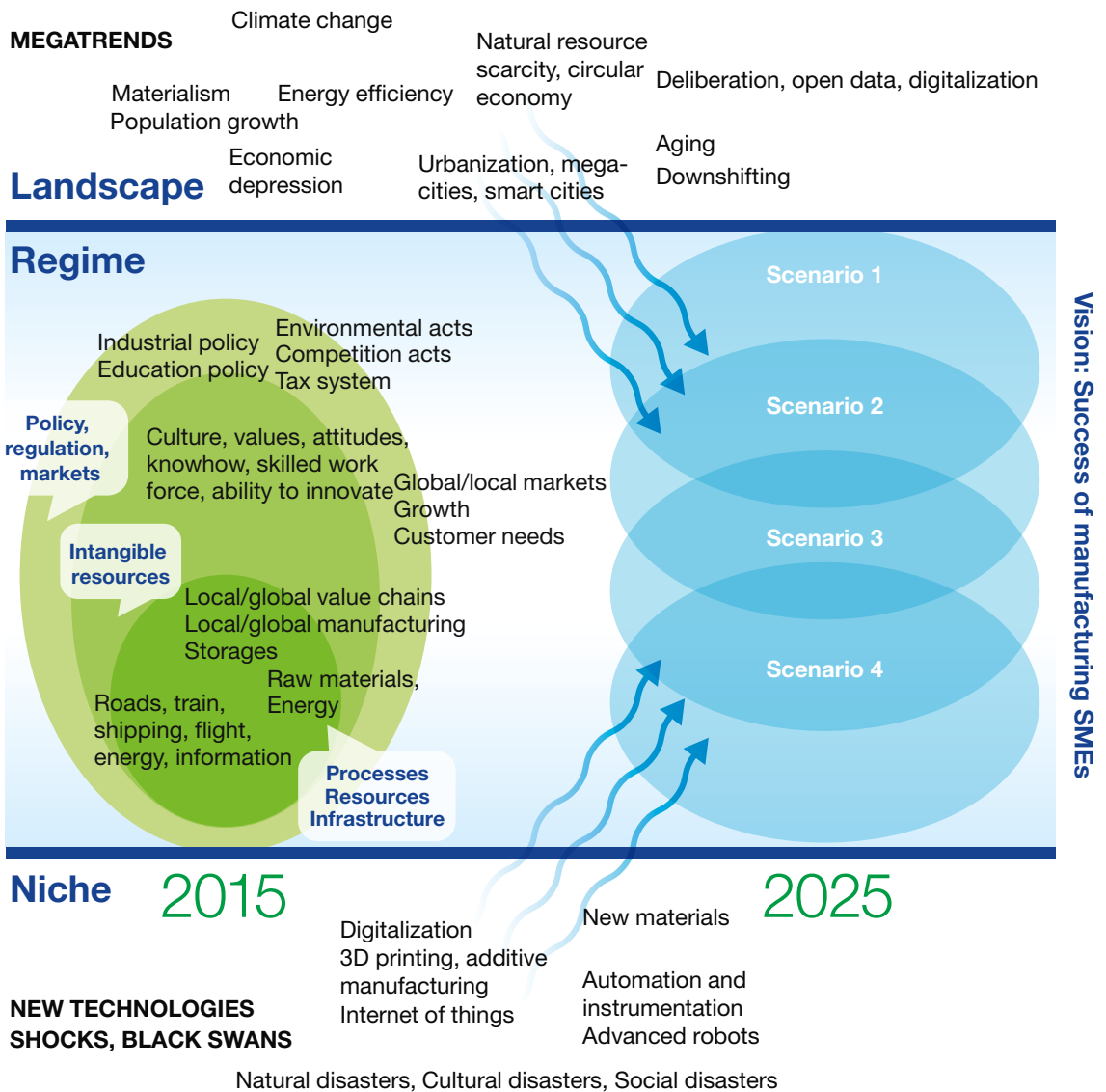


Figure 2. Key factors in multi-level perspective model

The niche level of society includes new technologies, local experiments, shocks and black swans. For example, digitalisation, automation and new materials will shape the existing system. The level may include special products which challenge the mainstream markets at the regime level. Severe natural, cultural or social disasters, such as earthquakes, terrorism or wars, which will highly confuse the system, may also occur.

When the regime is in change, all the levels are flowing in the same direction; landscape creates push and niche creates potential or shocks to the system change. Scenarios 1–4 will describe the potential new regimes. Figure 2 is a summary of the key factors shaping the future in the context of manufacturing, and it guides the generation of For Industry scenarios.

¹ Foxon, T.J., Hammond, G. P. and Pearson, P. J. G. 2010. *Developing transition pathways for a low carbon electricity system in the UK. Technological Forecasting & Social Change* 77 (2010), 1203–1213. Elsevier.

3. Four scenarios

A major goal of scenario working, in general, is to increase our readiness to face the future. This often takes place through a few quite different scenarios which force us to think in new ways. In the For Industry scenario work, we searched for identifiable key factors shaping the future, where such factors, scenario coordinates, can be used to create alternative scenarios with a broad, but still realistic, scope. We fashioned these results into two word-pairs: global – local and growth – scarcity.

The **global – local** word pair refers to manufacturing processes: whether they are happening in global or local value chains, and what kind of implications they have on the success of the Finnish manufacturing industry. The word pair also refers to markets, where the trend of globalization will continue or where the trend will turn into strong local markets for various reasons. In this word pair, we did not specify beforehand, in detail, the physical limits of the word “local”, which in this context may include city, region, country, or a union.

The word pair **growth – scarcity** refers to the scarcity of non-renewable raw materials and other resources, including the scarcity of a skilled workforce. Moreover, it refers to the fear of economic depression, which can create multiple problems for the manufacturing industry. However, it may also be that the future will offer economic growth and that issues related to limited amounts of raw materials will be resolved.

The word pairs define two axes leading to four scenario blanks, see Figure 3. The future worlds of the scenarios, presented in the following subsections, were generated in one large researcher workshop by considering PESTE-factors (political, economic, social, technological, and environmental) for each of the four scenario blanks. The creation of business aspects for the four future worlds then took place in four subsequent workshops. Representatives of manufacturing SMEs had the lead role in the generation of business aspects that finally led to the four scenarios.

The target year of the scenarios is 2025.

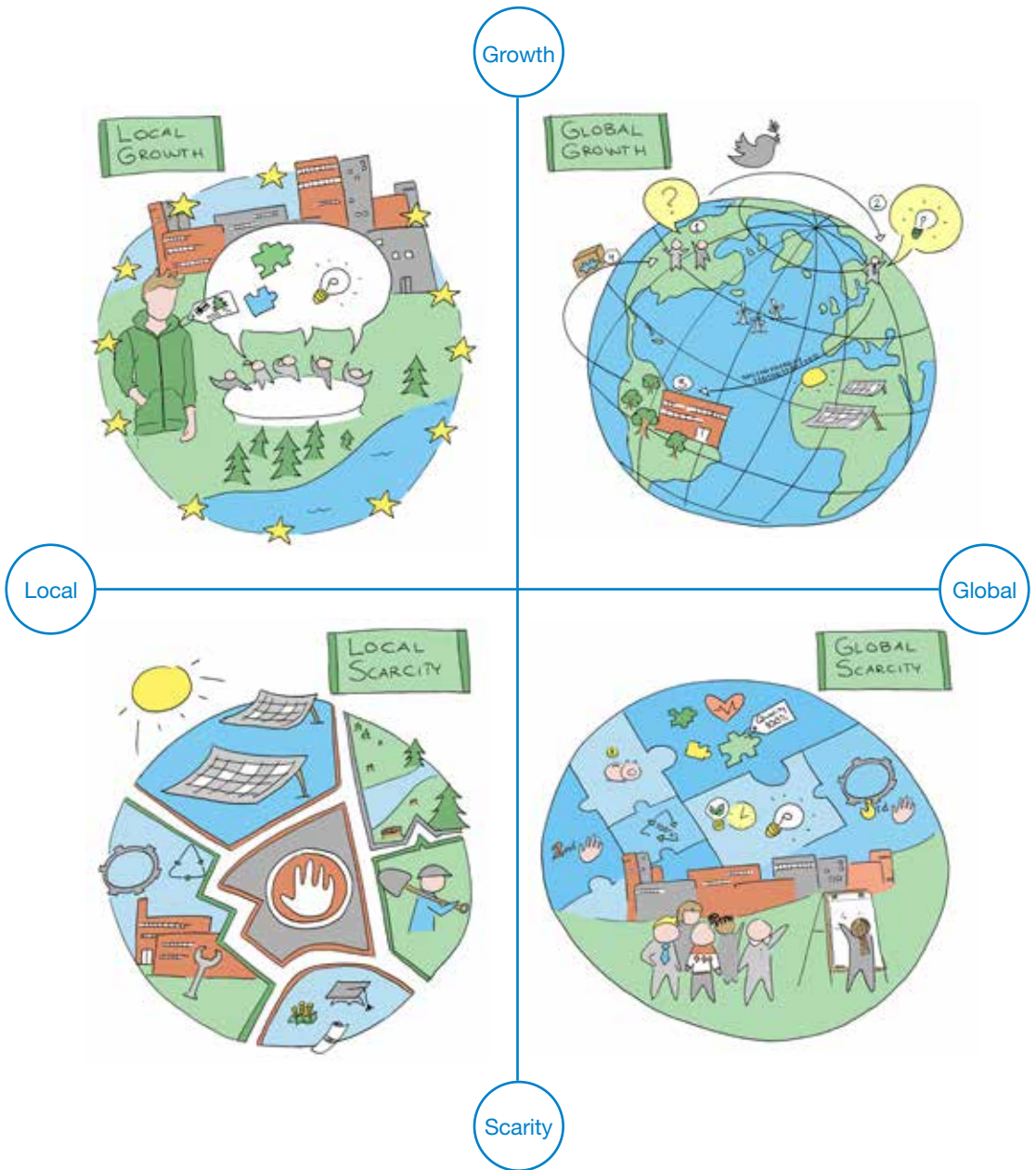


Figure 3. Four future worlds of For Industry Scenarios

3.1 SCENARIO: GLOBAL GROWTH

3.1.1 Global – growth: description of the future world

Long period of growth

The world economy has enjoyed an unusually long period of growth. The economic growth has taken place along with globalisation of businesses. World peace and good social order in main market areas supports the growth and globalisation. Growth had been driven, in particular, by Asia where urbanisation and a growing middle-class and materialistic way of living, in general, have acted as motors for the demand of new investments and consumables.

Global value changes of business, alongside with increasing level of digitisation, have supported reaching the status where the design of products often takes place in global networks, but the manufacturing can be local or global depending on the type of product. Heavy products are often manufactured close to markets, while light and middle or high-end products can be manufactured for global markets.

The markets on all the main areas are more fragmented, than ever before. This is due to increasing individualism that is seen both in products and services. And in addition to physical products and services, virtual products and services play a major role in the life of citizens in developed countries.

Towards a new era in globalisation

The continuation of economic growth has succeeded in overcoming all the shocks that have threatened its progress. Financial crises due to overly thin connections between financial markets and real profit capabilities of companies, large natural disasters, wars, and other conflicts has had large impacts on economies, but, has so far not stopped global economic growth.

However, in around 2020, it is widely identified that the risk of a shock that would stop global economic growth and globalisation is higher than it had been in decades. In addition to the increased probability of shocks described above, negotiations for true free trade, in a global sense, have faced problems and in environmental issues countries

in different parts of the world did not follow the same rules.

As a result, a larger social and political awakening takes place on a global level, where politicians and corporate leaders understand that we really must do something concrete and powerful together in order to save the continuation of economic growth and wellbeing in a sustainable way. The leaders understand that different kinds of shocks that threaten the system will take place and the system must be strong enough to withstand these shocks.

A global agreement is reached with a roadmap on how the link between financial markets and the profit capabilities of companies will be strengthened, the growth of competing trade groups between nations is stopped, and discussions for true free trade on a global level are restarted for full effect. In these negotiations, the main emphasis is on the removing of constraints for international eCommerce (taxation, customs duty questions, etc.) at all the levels of eCommerce (business-to-customer, business-to-business, and customer-to-customer). Also a global agreement aimed at sustainable use of energy is finally signed by all major actors. Distributed, integrated, smart and sustainable production of energy is favoured throughout the world.

Also in Finland, policy changes takes place at both governmental and corporate levels. The government policy puts an emphasis on versatile, agile, user-friendly and ecologic production. At the corporate level, the leaders decide to stop the used, almost adversarial, policy towards their SME suppliers and start to view them as partners (almost as family members), which leads to the re-establishment of trust between large corporations, their SME partners and the research institutes they collaborated with. They have already stopped their cost-cutting oriented corporate policies and started to invest in the future. As a result, SMEs are also encouraged to invest to the future.

The investment positive climate is seen as willingness to take controlled risks in new business development, internationalisation, investments in new capabilities, personnel and R&D. In regard to internationalisation, successful Finnish SMEs follow two main strategies: 1) partnering with large corporations in Northern Europe, especially in Finland and Germany, through which their products

can enter into global markets, and 2) joining global SME networks.

SMEs whose focus is on domestic markets experienced hard times. Effective business-to-business eCommerce helped SMEs not only in entering new markets, but also in finding new partners in new market areas. Value networks are truly global in all aspects. The networked way of operation also means that much of knowledge is joint and distributed over company boundaries into virtual multinational organisations.

Finland – the country of high design and user-friendly products for global markets

Thanks to the global and national business climate change, many Finnish SMEs in the manufacturing industry field reconsider their strategies and business models. In addition, many innovative start-ups are created. The structure of Finnish industry remains versatile, but in 2025 the competitive advantage is no longer based solely on high-technology. High technological quality is still an essential part of branding, but the competitive advantage is sought from design, functionality and user-friendliness of products.

Digitalisation is effectively used in business. Many companies are targeting niche markets and they tend to be among the top players in the world in the selected business. Finnish manufacturing SMEs are also known to be agile and effective in customising their offerings to meet changing customer needs in different markets.

Kemppi, Polar and Ponsse are considered to be examples of 2015 success stories of Finnish manufacturing SMEs in global markets. These companies also run well in global markets in 2025 as a part of global networks, but they have a number of Finnish followers in other segments of business.

3.1.2. Global – growth: key drivers and barriers for Finnish manufacturing SMEs

In the future world of global growth, competition is worldwide and hard. A manufacturing company must be strong and good at what it does in order to survive. The size of the company is not a key issue. Also an SME can do well in a specialised business. Other key issues in this scenario world are that there are many customers around the world with

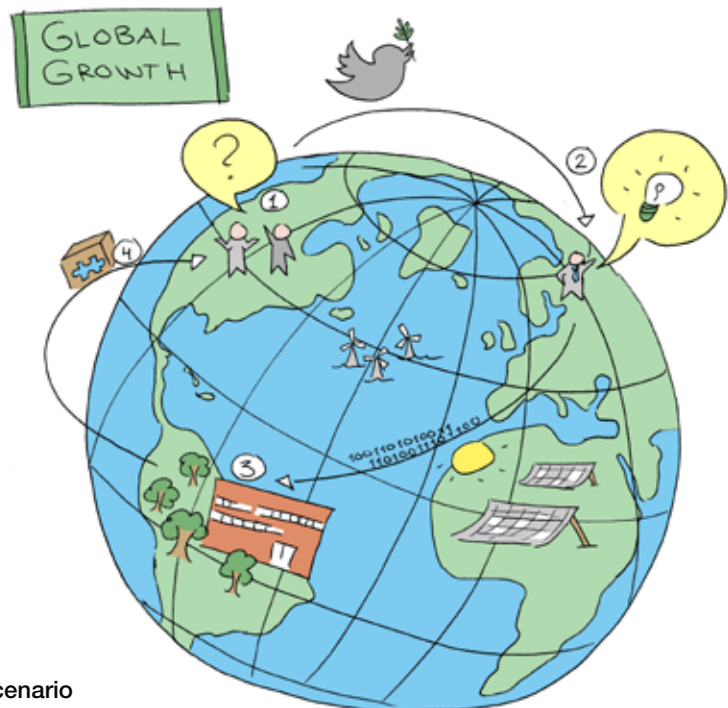
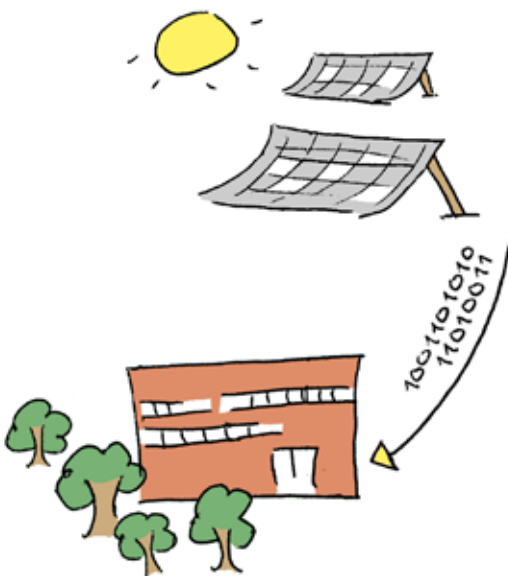


Figure 4. Global growth scenario

good buying power and the markets are growing in a global sense.

The world of the scenario is highly digitalized. Information is moving fast around the world through digital media, which has important impacts on market behaviour and on manufacturing processes.

Customers in the digitalized and globalized world of growth are very market and fashion-conscious, leading to strong and rapidly changing cycles of demand. Market megatrends come and go quickly, applying not only to consumer markets but also to business-to-business markets. Markets are also highly diversified. Customers with good buying power seek products and services that completely fulfil their specific needs.



For manufacturing processes the digitalized and globalized world mean, for example, effective use of global value chains with distributed design and manufacturing. Digital processes cover both production and marketing, including delivery logistics. Additive manufacturing (3D printing), together with eBusiness/eCommerce, will challenge current business models in production, marketing and delivery.

Value chains in future manufacturing business models may be very different from those we see today. Active and effective utilization of cloud services is an important part of many manufacturing industry business models and covers several parts of the models (marketing, production, resources, etc.).

In the world of global eCommerce, different kind of wholesale dealers will have more important roles than they have today. For them, the price of a product is the top purchasing argument. Quality still matters, but it is very hard to gain any competitive advantage by quality because a good quality is a must in order to attract the interest of a wholesaler. The situation is the same for wholesale dealers in business-to-business and business-to-consumer markets. Large wholesalers prefer to deal with large supplier actors, which makes it hard for a Finnish manufacturing SME to conduct business through this delivery channel.

In this world of wholesalers, it is also hard to successfully introduce innovations. Innovations, however, are still important for Finnish companies to be successful.

Another barrier for Finnish manufacturing SMEs in the future world of global growth is weak capability to recognize customer needs in rapidly changing markets. This may not be true for every manufacturing SME, but for most SMEs it will be.

The stiff competition will also create challenges in maintaining the innovation capability of a company. Although it is hard to successfully introduce innovations, innovation capability is still one of the key assets in global business. The innovation capability of a company is influenced by the company culture as well as by the personal capabilities of its employees. The latter calls for high quality in the Finnish education system.

In a globalized world, the power of religions in business should not be underestimated. Religions may not form a driver for business, but religion related cultures may easily create various kinds of barriers for business that may arise abruptly. An SME simply must be able to navigate through these barriers.

In the description of the future world, large corporations are said to have started to see their SME suppliers as partners (almost as family members), which has led to the re-establishment of trust between large corporations, their SME partners and the research institutes they collaborate with. This family kind of team spirit would increase the competitiveness of Finnish manufacturing industry in global competition.

It has also been said that corporations have stopped their cost cutting oriented corporate policies and started to invest in the future with their SME

suppliers. But what if these things do not happen and short-sightedness and lack of trust in the Finnish manufacturing ecosystem continues? Obviously, that would be a significant hinder to Finnish SME competitiveness in the future world Global growth.

3.1.3. Global – growth: business success factors for Finnish manufacturing SMEs

As stated above, a manufacturing company must be strong and good at what it does to survive in the future world of global growth. By this, we mean that the company must have high levels of business and technological capabilities and, in the case of an SME, it has to specialise and focus on niche markets. Large corporations can be competitive with broader technological and market scopes.

Business capabilities that are critical for success in the world of global growth include a few key issues. Strong presence in global eCommerce, in one way or another, is essential for an SME. However, it will be extremely difficult for a small company and its products to be distinguishable among thousands of similar items in electronic commerce. Recognition calls for support by personal sales work.

Personal sales work will be extremely important for local distributors in foreign countries. Although large wholesale dealers will dominate in the future world, local distributors still play a role in the world. Local distributors often operate in highly specialised (niche) markets. For them, a good product and the fulfilment of the specific needs of end-customers are very important, the price of a product often being

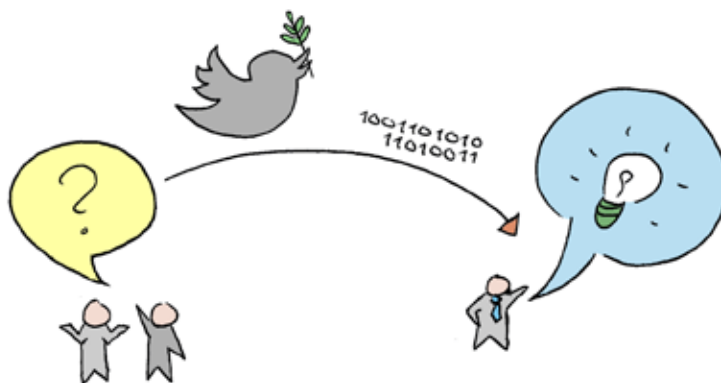
a secondary argument. This would mean a major opportunity for Finnish manufacturing SMEs, provided they have the proper offering and are capable of producing and delivering small batches and series.

Therefore, we can conclude that local distributors will play a critical role in the delivery chain of Finnish manufacturing SMEs in global business. Successful business with local distributors calls for good sales skills in international business, which is perhaps the most important success factor for Finnish SMEs in the future world of global growth.

Another channel for the delivery of products of Finnish SMEs is partnering with large international corporations. In that business model, Finnish manufacturing SMEs supply specialised sub-parts or assemblies for the client through which the SME's products can enter global markets. The large partner corporation (client) is typically located in Northern Europe (Finland, Germany, etc.).

From technological viewpoints, a manufacturing SME can strengthen its position and capabilities by being an active member of a design and manufacturing competence cluster, provided that the competence cluster is strong, in a global sense. The competence cluster may consist of other SMEs, large corporations, research institutes etc. Physically, they can be local or distributed around the world.

The amount of global competence clusters in 2025, will be much higher than today. Thus, we can say that international partnering and global SME networks will be among the most important success factors for SMEs. This applies to an SME's technological competence as well as its business processes.



3.1.4 Summary of scenario global growth

The scenario global – growth is summarized in Table 1.

Table 1. Summary of the global – growth scenario

Key features of the scenario world global - growth

- Global value chains, world of free trade
- Customers have buying power
- Focus on the needs of customers
 - Many needs have strong and fast cycles
 - Diversified markets
- Competition is global and hard
- Finnish companies are producing (as a part of value chain) design products for niche markets
 - Quality is base (not an asset)
 - Easy to sell and use
 - Agile manufacturing, small series/batches

Key drivers

- Digitalised world
- Effective use of global value chains with distributed design and manufacturing
 - eBusiness
 - 3D printing
 - Cloud services
- Excellent know-how and co-operation in R&D

Barriers

- Short-sightedness and shortage of trust in the Finnish manufacturing ecosystem between large and SME companies (no collaboration)
- Weak capabilities to recognise customer needs in rapidly changing markets
- Maintaining innovation capability

Business success factors

- High level of technological and business capabilities
 - Competence clusters in design and manufacturing that are globally strong
 - International business sales skills
- Specialization and focusing on niche markets
- International partnering, global SME networks
- Small series production

3.2 SCENARIO: LOCAL GROWTH

3.2.1 Local – growth: description of the future world

A new entrepreneurship favourable atmosphere is dawning in Finland

In late 2010s, entrepreneurship and new business development are favoured by the Finnish government. The policy supports domestic pilots for new kinds of businesses and niches. The atmosphere is favourable for new entrepreneurs and Finnish-owned small and medium sized companies.

Forests are growing faster than ever, and resources of pure water were tremendous. Finland is seen as a country of rich raw materials, where local production and home markets are trusted. Domestic energy solutions (including peat, nuclear, water, solar, wind and bio energies) are considered as positive. Finland has skilled labour in digitalisation and automation technologies, and the automation business is growing fast. Additive manufacturing is creating new structures for industrial production.

Large global value chains have shown their

vulnerability, especially in ethical and quality aspects, and local production seems to be a better option. Stock market volume also diminishes as entrepreneurs value long-term development of business instead of quarterly monitored stock market business.

The role of inside markets with the European Union is strengthening, and forms the main market area for nations of western and northern culture in the European Union (Finland is among this group). Production near mass populations of Asia and South-America is no longer seen as a competitive advantage. However, globalisation is still utilized in education, with many students spending several months or more abroad, including outside Europe, learning new ideas and cultures. This mobility in education, is heavily supported by the government.

Towards local innovations and business

Cities are strong in the 2020 world. Urbanisation is a megatrend and most people are living, working and spending their leisure time in metropolitan areas. Metropolises constitute strong economic areas where manufacturing industry value chains can be completed and create local vivid markets. Metropolitan areas do not necessarily respect national borders;



Figure 5. Local growth scenario world



for instance, Helsinki and Tallinn form a unified market area.

In 2020, the most important criteria for public purchases are domestic raw materials, and design and production. The governmental policy supports this direction by providing intermediary organisations, such as Motiva for energy services and other substance specific organisations, to assist in local public-private partnership actions.

These intermediary organisations help public partners find relevant private actors in the markets. The Acquisition Act no longer strongly binds the decisions of public actors. Instead, regulations direct decisions toward innovative local solutions.

Fostering local services in public purchases stimulates local markets and encourages citizens to use local services and products; real home markets in the EU are opening. Made in the Nordics or in Western Europe is a product quality guarantee. Heavy custom tariffs are set on products imported from outside the EU.

The culture in Finland promotes innovation. A citizen's salary is taken into general practice, which saves public social costs by releasing labour from filling in and dealing with various forms. The citizen's salary also enables lower company salaries. This is beneficial for local family businesses. The higher education level of citizens and international student exchange systems guarantee that new ideas and innovations emerge and are implemented into businesses. Finland continues to improve its capabilities in research, design and innovation.

Tailored modular products, for instance in wood working industry, are successful on European markets. Local raw material stock is efficiently used and organised; wood markets are lively, sustainable and profitable, and mineral and metal production is active. Also, the domestic textile industry is boosted due to new fibre based materials made from Finnish pulp.

Finnish bioenergy is a brand, although other renewable energy markets, for instance Finnish solar panels and wind mills, also flourish. Finland is energy self-sufficient, and simultaneously exports technology and equipment for renewable energy production and energy efficiency.

In addition, Finnish industry is manufacturing products for consumer mass markets, Finnish products are well branded, and intellectual property rights are actively used in the businesses.

Finland – an Eldorado of innovation and local business

The positive development in Finnish society and culture are summed up in the successful concept of Innovation Factory. The concept consists of workshops and concrete places where skilled people are innovative and develop their ideas. Beside the innovation factory, there is a concept of a Pilot Factory, which focuses on the development of industrial production. The Pilot Factory operates at the European level.

The family-business based Finnish industry is developing product ideas, patiently, without rapid profits in mind. High-spirited local markets keep manufacturing SMEs prosperous. The competitive environment is health without monopolies. Finnish production of innovative and competitive solutions is strong in 2025.

3.2.2. Local – growth: key drivers and barriers for Finnish manufacturing SMEs

In many ways, the future world of local growth represents a world that is quite different from today's Finland. Key drivers of change towards the future world include ethical and environmental production problems for many countries in Asia, Africa and South America, low quality products manufactured outside the EU, and increasing protectionism in different parts of the world. These factors will cause people in Europe to tire of globalization challenges. People will also want to engage in voluntary protection from the increasing power of the Asian economy.

Another factor that is driving the system towards the future world of local growth is the increasing trend of very local products, such as organic food

from neighbouring farmers.

Migration of refugees to Europe due to wars and natural crises is also a driver in this scenario. In this scenario, however, immigration is controlled and has a positive impact on the system. Through immigration, Europe gets a new workforce and, while the large numbers of refugees simultaneously forces governments to make changes in regulating entrepreneurship and employment. As a result, many refugees successfully become entrepreneurs.

People in the future world of local growth admire family businesses with their own products, whose markets do not depend on supplier chains of global corporations. Successful companies also have a strong local character – they are strongly rooted in their hometown, and many companies have built up a lively local ecosystem around them. In the local ecosystems, both large and small companies collaborate in close and trusted relationships.

There are a few main barriers in the scenario for Finnish manufacturing SMEs. Perhaps the most important barrier is related to resources: what will happen if there are not enough actors, entrepreneurs and financiers in Finland to realise the concepts of Innovation and Pilot Factories and the consequent business? In this case, Finland and Finnish manufacturing SMEs will not enjoy the economic growth that is taking place in Europe in 2025. By actors, we mean a skilled workforce in research, design, innovation, production and sales.

The vision needs a large number of skilled entrepreneurs that are willing to take the risks that always accompany innovation, new business generation,

and business growth. Innovation and the growth of business often requires large financial investments before a company achieves a positive cash flow. This cannot take place without sufficiently large financial markets.

The scenario assumes that unnecessary bureaucracy and regulation are decreased in Finland. But the competitiveness of Finnish manufacturing SMEs in European markets is also influenced by actions taken by other governments in Europe. If European regulations are not harmonized, Finnish SMEs may not receive a competitive advantage from the changes.

The last discussion on barriers in this scenario concerns the question, how strong a driver is locality in business-to-business? If money is the key driver instead of locality, then large companies will rule the manufacturing ecosystem and SMEs may suffer. That will certainly negatively impact the innovation capabilities of manufacturing SMEs, which is one of the key assets in the scenario.

3.2.3. Local – growth: business success factors for Finnish manufacturing SMEs

The world of local growth is highly similar to the world of global growth when considering business success factors: the effective use of digitalisation at all levels of business, own products and/or services, brands, skilled employees, sales skills, emphasis on design and usability of products and services. Here, high quality products are a requirement, not an asset. A company must be good at what it does in order to survive the competition, which is not always as hard as in the globalized world.

There are also big differences between the growth scenarios. In the world of local growth, the value chains are not global. Instead, they have pronounced local character emphasising a specific metropolitan area or region. Also, the products have pronounced local characteristics. Accordingly, the world of local growth, family business with their own products that have a local character are admired. For Finnish manufacturing SMEs, the use of Finnish raw materials creates a special competitive advantage on European markets. Accordingly, bio-economy is in favour. Circular economy is another model in



favour, in this future world. It is preferred to substitute, non-renewable, raw materials that were previously imported from outside the EU.

As already mentioned above, the world of local growth is a world of innovation. Successful Finnish manufacturing SMEs are innovative. Innovativeness can be seen in products, in services, in manufacturing methods, in business models, etc. Being successful in innovation calls for a company to have innovative and skilled employees and that it takes

part in innovative competence networks. Moreover, a company should have a sufficiently attractive labour policy.

Being successful in innovation also requires the company to be able to financially invest in innovation and that it displays patience in waiting for business growth. The world of local growth is a world of slow financing to support long-term business development. As a result of this, many future products of Finland are better than the foreign products they replace.

3.2.4 Summary of scenario local growth

The scenario local – growth is summarized in Table 2.

Table 2. Summary of the local – growth scenario

Key features of the scenario world global – growth

- EU (or Northern Europe) forms the main business area
 - Only minor emphasis on global value chains and business
- Urbanisation and metropolitan areas are important
- Family businesses with their own products are admired
- Innovation driven world where locality is a strong asset
- Finnish companies are designing and manufacturing innovative products with effective use of local raw materials and designs

Key drivers

- People have become tired of the challenges of globalization (quality, ethical issues, environmental issues etc.)
- Buy European, buy local
- Migration of refugees to Europe has a positive impact on the system

Barriers

- If money is the key driver instead of locality, then large companies will rule and SMEs may suffer
- If there are not enough actors, entrepreneurs and financiers in Finland, Finland will not enjoy the growth
- Overly complicated regulation (as compared to an average European level)

Business success factors

- Slow financing to support long-term business development
- Innovativeness
- Strong know-how with high quality education and expertise
- Own sustainable quality products and/or services
- Bio-economy, circular economy
- Effective use of digitalisation at all levels of business

3.3 SCENARIO: GLOBAL SCARCITY

3.3.1 Global – scarcity: description of the future world

Lack of raw material changes the world

The growth of population and a materialistic way of living on the planet has led to a situation where some non-renewable raw materials are no longer available at affordable prices for manufacturing. The scarcity of non-renewable raw materials starts to change the world. In particular, the scarcity and high market price of rare earth metals, phosphorous and copper has had a great impact on societies worldwide. Governments or large global corporations take strict control over natural resources in many countries through ownership and controlling the use of and business with raw materials. Business is, however, still global with global manufacturing value chains and free trade dominating in most parts of the world through bi- or multilateral agreements.

The importance of circular economy is rising due to the growing price of scarce, non-renewable, raw materials. Arctic mining is active, but arctic activities simultaneously strengthen environmen-

tal movements, since mining takes place at the expense of sensitive arctic environments. A form of counter-materialism is emerging in society. As a result, the number of consumer products and other kinds of products diminishes. This counterforce to materialism stresses quality by requiring durable and repairable products.

Climate change has increased along with population growth, limiting the availability of food and fresh water in several parts of the planet. As a result, masses of people start to migrate to areas with better living conditions. Due to this emigration, labour markets become globalised.

The Finnish government tends to create new jobs by encouraging new business to evolve, but the situation is hectic. Simultaneous to the need to create jobs and ensure high education levels, there is a growing trend to move to India and other swiftly developing countries, which attracts young people with low costs of living. Emigration is vast and uncontrolled. Globalisation also offers the potential for multicultural labour in Finland. The global education business, however, weakens the Finnish education system as many students now study abroad. As a result, this development also increases the scarcity of skilled Finnish labour, as talented young people move abroad.

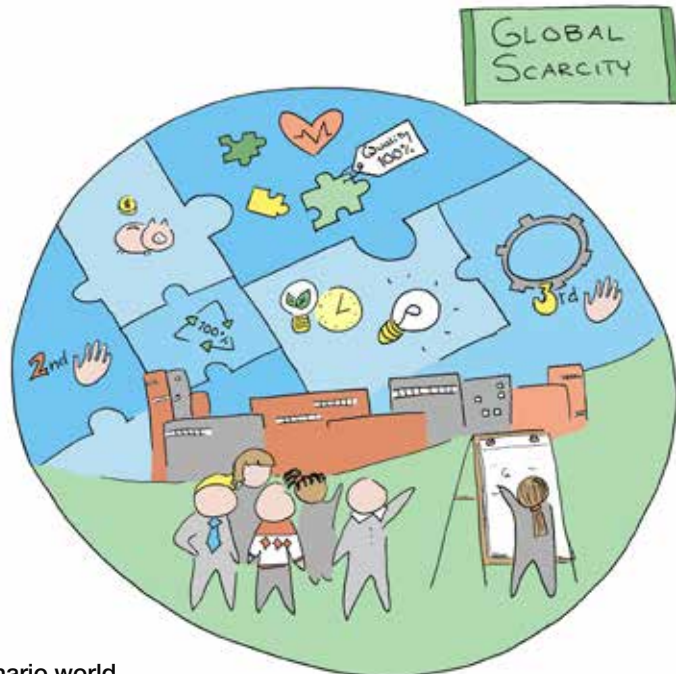


Figure 6. Global scarcity scenario world

Efficient material and energy use

Efficiency in the use of materials and energy is the leading principle in the manufacturing industry. Products are compact and made by using as small amount of material as possible. Special emphasis is placed on increasing the durability of goods. The scarcity of raw materials inspires new innovations, especially in material technology.

The global resource scarcity also causes restrictions in the use of materials. This opens up new business opportunities for resource efficient technologies, as well as for systems controlling and monitoring the efficient use of materials and energy. In particular, systems applying the Internet of Things (IoT) are used in the controlling and monitoring purposes. However, the scarcity of rare earth metals makes the IoT system very expensive.

Urban mining technologies are also of great interest. Many old natural ores are already quite scarce, but old landfills offer better opportunities for mining metals needed for high-technology products, such as portable devices or equipment for energy technology.

Finnish resource efficient products gather global reputation

In 2025, there is a strong and global political consensus in support of resource efficient products and production. Life-cycle based manufacturing is a must. Products are tailored modular products that can easily be reused. The focus is put on quality, not on quantity. The importance of product and manufacturing design is growing, as the products must be resource efficient, reusable or recyclable, and above all durable.

The share of labour costs in the total manufacturing costs has decreased and the share of material costs increased, as raw materials have become expensive due to scarcity. Hence, it lowers relative production costs in Finland when compared to costs in countries where workforce costs have traditionally been much lower.

Enterprises have learned to exploit multicultural Finland in their business, and the vivid and global workforce markets have lowered salary costs tremendously. The Finnish manufacturing industry is full of foreign workers, including design and research, and development: labour markets are open to the globalised world.

Products are much more effective, compact and resource-efficient than, e.g., they were 10 years ago. Health monitoring and IoT based control equipment are examples of products from Finnish manufacturing SMEs exported to global markets. The products are mainly produced from reused and recycled parts.

3.3.2. Global – scarcity: key drivers and barriers for Finnish manufacturing SMEs

Circular economy and efficient use of materials are among the key drivers of business for Finnish manufacturing SMEs in the world of global scarcity. The most important driver, however, is the customer demand for durable and energy efficient goods. The Finnish manufacturing industry has traditionally been used to designing and manufacturing such kinds of products. What they still need to learn is the efficient utilization of reused and recycled parts and the designing of products with reusable parts and materials. Digitalization and IoT greatly support efficient use of a circular economy in helping with the scarcity of raw materials. Customers are in favour of sustainable and durable goods.

The price of a product still matters, but customers emphasise overall costs over a product's life-cycle. From a manufacturing viewpoint, the fact that price remains very important indicates great attention must be given to manufacturing cost efficiency throughout the manufacturing value chain.

The migration of people due to climate change is also an important driver of global business. When people leave their old home, they only bring a limited number of personal items with them. They need different kinds of necessities in their temporary residence and at their final destination. Finnish manufacturing SMEs may well find some niche products to fulfil demands in these markets.

Another specific market for Finnish manufacturing companies arises due to the aging of populations in developed countries. Aging increases the markets for health care products and monitoring equipment. In these markets, a successful market entry for an SME often requires partnering with other actors (large companies, SME networks, financiers).

The increased proportion of material costs in the total price of a product has decreased the role of labour costs in manufacturing. As a result, manufacturing in Finland has become attractive in a global sense. Due to emigration, a basic workforce is available but, at the same time, the mobility of experts and skilled workers is very high, which may lead to a scarcity of a skilled work force.

The scarcity of a skilled workforce is further influenced by the fact that the Finnish education system does not produce enough skilled experts. For an SME, all that, may be an enormous barrier to success. One of the main challenges for an SME in this world is how to keep its top employees satisfied so that they do not seek an employment change.

The world of global scarcity also includes some very specific barriers for an SME. The fact that governments and large global corporations control the use and business of some critical raw materials can be very harmful to other actors. That may lead to situations where market forces do not actually control global markets. Instead, a few key actors may control events on global markets. In this kind of world, Finnish manufacturing SMEs can minimise their business risk by lowering their dependency on such raw materials and relying on recycled raw materials, and on raw materials that are under the control of the Finnish government.

One important business barrier in the world of scarcity is that people are used to buying cheap products and services from the times before scarcity began to dominate the world economy. In this new era, prices are not lower, but global competition creates strong pressures to keep prices as low as possible. As a result, margins may be very small unless the manufacturing company is extremely good in their sourcing and use of raw materials.

Transportation costs are high in the world of scarcity, but it is case dependent as to whether or not this is a driver or a barrier for a Finnish manufacturing SME. For an SME targeting global markets, it may be a barrier but, high transportation costs decrease the interest of foreign companies to export heavy products to Finnish markets.

3.3.3. Global – scarcity: business success factors for Finnish manufacturing SMEs

Business success factors for Finnish manufacturing SMEs in the world of global scarcity are already mentioned above. They include the efficient use of resources, including material and energy efficiency, and Finnish natural raw materials. Circular economy is a key word for success. Digitalisation should support the efficient use of resources. Finnish companies should also focus on high value added products from local raw materials to global markets.

Sales skills are of great importance in global markets. In this sense, the world of global scarcity is by no means different from the world of global growth. What was said in Chapter 3.1.3. about how to be successful in the context of global growth also strongly applies, here, in the context of global scarcity.

The scarcity of a skilled workforce and the high mobility of employees create major challenges for Finnish manufacturing companies (that will be a problem for both large companies and SMEs in the future world of global scarcity). In order to be successful, they must find ways to keep their critical employees satisfied so that they will stay with the company.



3.3.4 Summary of scenario global scarcity

The scenario global scarcity is summarized in Table 3.

Table 3. Summary of the global – scarcity scenario

Key features of the scenario world global - growth

- Global value chains, world of free trade
- Scarcity of some critical raw materials, which has made them very expensive, also energy is expensive
- Governments and giant global corporations own and control the use of raw materials
- Global labour markets – immigration and emigration
- Focus on quality and durable goods
- Finnish companies are manufacturing durable and resource efficient products and the manufacturing is aligned with a circular economy

Key drivers

- Circular economy
- Customers are in favour of sustainable and durable goods
 - Price still matters, but the focus is on overall (lifecycle) costs – cost efficiency is very important
- Migration of people due to climate change

Barriers

- Customers have been used to buying cheap products and services
- High costs of materials, energy and transportation
- Availability of top-skilled experts - high mobility of the experts

Business success factors

- Efficient use of resources
 - High value added products from Finnish raw materials to global markets
 - Utilization of circular economy
 - Use of digitalisation to support the efficient use of resources
- Partnering with global corporations and competence clusters
- Sales skills in international business
- Maintaining the high level of education and skills as well as keeping key employees satisfied

3.4 SCENARIO: LOCAL SCARCITY

3.4.1 Local – scarcity: description of the future world

Export restriction on non-renewables

The centre of economic gravity had shifted to Asia because the economies of newly industrialised countries – especially in Asia – continued to grow. This shift brought forth divergent customer behaviour and demand for manufactured products (e.g. smaller, cheaper and more efficient cars for the Indian market). In the divergent market, manufacturers that employ localised development and design activities thrive. For far away manufacturers, it is often hard to understand the user environment and the nuances of what is important to the end user.

In the growth wave of newly industrialised countries, the world enters an era of relative resource scarcity. The situation further feeds itself, as more attention is drawn to the restrictions imposed on the export of strategic natural resources. Governments apply export restrictions to manage the sharp increase in prices and to guarantee the availability

of non-renewable resources for future self-interest. Foreign affairs and national trade policies become increasingly intertwined. Bilateral and regional trade agreements, aimed at enhancing supply security of strategic resources, become omnipresent.

The emergence of market divergence coupled with the era of relative resource scarcity forces companies to operate more locally. This does not mean the end of global organizations, but instead a necessary shift in their operations. Global organizations operate increasingly locally through sets of subsidiary companies or strategic partnerships. In a global context, Northern Europe has developed into the region that defines what local means in Finland.

Functioning effectively with minimum waste

In 2025, the scarcity of available natural resources has emerged as the dominant environmental concern. Access to non-renewables is increasingly difficult and expensive. Decisions to restrict the export of rare earth metals has sent worldwide ripples, leading importing countries to consider opening domestic mines, investing in alternative technologies, and boosting recycling efforts. Waste management, when concerned with strategic resources, becomes



Figure 7. Local scarcity scenario

a necessity. Meticulous resource utilisation, remanufacturing and exploitation of biomaterials becomes standard practice in the manufacturing industry.

Scarcity of non-renewables is, simply, one of the key drivers for research and development activities. New materials are more easily repurposed, durable and readily available than the old ones. Re-usability of parts and materials is one of the key design principles in product development. New manufacturing techniques let engineers shape these materials on a minuscule scale. Additive manufacturing, micro-electro-mechanical systems and nanotechnology provide enhanced features and radically reduce the required amount of resources absorbed by each manufactured product.

Despite the material saving achievements, average prices of goods is much higher than they were ten years ago, and commodities have nearly become investments goods for many people.

The exploitation of non-renewables slowly makes way for the exploitation of renewable resources, sometimes even at the expense of the environment. The increasing use of some renewable resources (e.g. biofuel) imposes new environmental concerns and spurs eco-protests.

Knowledge-based Finnish economy suffering scarcity of skilled labour

Developed countries, that lack non-renewable resources, are building their competitiveness via educated and skilled labour. New intricate products and the penetration of information technologies have made skilled labour more valuable, and their salaries and labour prices are growing. The Finnish manufacturing industry promotes access to a wide range of skills through collaborative ecosystems and strategic partnerships, but it often remains hard to hire and maintain a skilled workforce in an aging population.

At the same time, there are many less skilled workers in low-paying jobs and the unemployment rate is high. Labour market demand and supply are unequal. As a result, the average buying power of citizens is poor (taking into account the high prices of many commodities).

Climate change and other crises are driving masses of people to migrate towards areas with better living conditions. Northern Europe, including Finland, used to be a favourite target for emigration



in the late 2010s. Emigration becomes unmanaged, which leads to restricted mobility of people at European borders, as well as between European countries. Mobility restrictions are still in place in 2025, which fact does not help the scarcity of skilled labour in Finland.

Digitalization and the global trends towards localized manufacturing creates opportunities for small and medium sized enterprises. Cultural and societal crises, e.g. wars and terrorism, as well as natural disasters and extreme weather conditions due to climate change, make the global value chains in manufacturing insecure. This strengthens the attractiveness of local markets and creates good opportunities for the birth of local value chains and their success. There is a strong need to substitute imports to the EU with own local products (i.e. products manufactured in Northern Europe).

3.4.2. Local – scarcity: key drivers and barriers for Finnish manufacturing SMEs

The most important driver in the future world of local scarcity is the need to substitute imports from outside the EU. That need applies both to commodities and raw materials. Import of items that used to be imported from other parts of the world is either no longer possible due to restrictions on export of non-renewables or that they are too expensive.

The need to substitute import of commodities outside the EU by local manufacturing is a big boost for Finnish manufacturing SMEs. At the same time, it is a major challenge, as it calls for capabilities that are new to the company and new resources, such as raw materials, which may not be readily available to an SME. SMEs may become highly dependent on material suppliers.

The need to substitute the import of raw materials from outside the EU is a driver for material

research and development, as is effective implementation of a circular economy, reuse of materials and re-engineering. That stated in Chapter 3.3.2. on the implementation of a circular economy also applies quite well in the world of local scarcity. The main difference between the global and local scarcity worlds is motivation: in the world of global scarcity the circular economy, is to some extent, a voluntary action to make products affordable. In the local scarcity world, there are hardly any alternatives.

Another difference between the worlds of scarcity is that there may be a severe shortage of money in the world of local scarcity. It would mean, for example, that although there is a strong need for research, development and innovation, there will be no resources for these activities. In local scarcity, and despite the effective use of a circular economy, SMEs may suffer from the poor availability of substitutive technology, equipment and components, which may create a severe business barrier for many manufacturing SMEs.

The fact that commodities have nearly become investment goods in the world of local scarcity can act as both a driver and a barrier for a manufacturing SME. It can be a driver because people usually actively seek attributes like quality, durability, life-cycle management for investment goods. These are attributes that have traditionally characterised the products of most Finnish manufacturing SMEs (independent of whether the company is producing sub-parts, assemblies or end-products). But it can also be a barrier because the average buying power of citizens is poor. Customers have been used to buying cheap products and services, however, investment goods are not cheap.

Another key barrier for manufacturing companies is that supply and demand do not correspond well in labour markets. There is mass unemployment, but at the same time, many companies suffer from

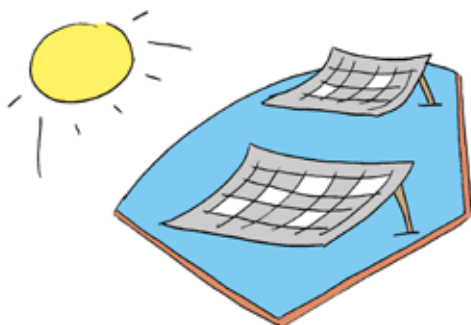
a lack of a skilled workforce in several fields. Mass unemployment, low buying power and the high price of commodities may also feed a grey economy, which would be detrimental to society.

3.4.3. Local – scarcity: business success factors for Finnish manufacturing SMEs

Business success factors for Finnish manufacturing SMEs in the world of local scarcity are to some extent similar to those reported in Chapter 3.3.3. for the world of global scarcity. They include efficient use of resources, including materials and energy efficiency, as well as Finnish natural raw materials (the latter is an even more important success factor here, than in the world of global scarcity). Circular economy and digitalisation are key words. The scarcity of a skilled workforce creates a significant challenge for Finnish manufacturing companies.

In addition, there are some success factors specific to the world of local scarcity. Substitution of import creates opportunities, for example, for repair, remanufacturing, and re-engineering businesses. There is also a significant need to manufacture commodities that were manufactured in Finland a long time ago, but whose production was gradually moved to Asia in the 1980's – 2000's.

If the company has a capability to respond to the listed market needs, it has factors of success in its hands, since many manufacturing SMEs may not have a capability to be agile enough and re-orient its business. To be successful, one has to have versatile production capabilities, multiple skilled employees that can jump into new fields, create networks, integrate knowledge and technologies to form larger entities, and, finally, sell them to new customers.



The world of local scarcity clearly addresses versatility instead of deep specialization, which is important in the other scenarios of the study. In the local scarcity, the SME must also be financially strong enough to be successful in the reorientation of its business. For those entrepreneurs, who would

be successfully in the re-orientation of their business model to meet the business requirements of the world local scarcity, the scenario world could offer attractive opportunities of business in Finland and in Northern Europe.

3.4.4 Summary of scenario local scarcity

The scenario local – scarcity is summarized in Table 4.

Table 4 Summary of the local – scarcity scenario

Key features of the scenario world global - growth

- Local markets are developing (Northern Europe)
 - Global value chains are insecure
- Borders between countries or unions
 - Restrictions to the export of non-renewables
 - Restrictions to the mobility of people
- Scarcity of some critical raw materials, skilled labour and buying force
- Finnish companies are manufacturing commodities for local markets (i.e. goods that used to be imported from Asia)

Key drivers

- Need to replace import outside EU
 - Commodities
 - Raw materials
- Commodities become “investments” for buyers

Barriers

- Poor buying power of citizens
- Customers have been used to buy cheap
- Availability of substitutive technology, equipment, components
- Mass unemployment
 - But at the same lack of skilled work force in many works

Business success factors

- Agility to re-orient the business
 - Versatile production to replace import
 - Re-manufacturing, re-use, circular economy
 - Efficient use of local raw materials
- Multiply skilled persons that can jump into new fields, create networks, integrate knowledge and technologies to form larger entities
- Ability to commit talented and high quality work force
 - High quality education system (but skills needed in local scarcity are scenario specific)

4. Discussion about the scenarios

4.1. DISCUSSION ON HOW TO READ THE SCENARIOS

Before a more detailed discussion on how to be successful in the future worlds is given, it is important to understand a few basic principles of the For Industry scenario work. This helps to ensure gaining the full benefit of the study.

First, the four scenarios shown are unlikely to be an actual representation of the future world. It is more likely that the future will include features from two or more of the potential scenarios. That is why the scenarios overlap in Figure 2.

We have made no predications as to the most likely scenario. Such speculation does not belong in a study where the aim is to expand the mindset of readers when considering alternative scenarios of future. When a company incorporates the For Industry scenario work into its own strategy work, it could then speculate what kind of future will be most probable for them. Even then, the company should still prepare for alternative future scenarios.

Second, all four scenarios purposely include a couple of features that may be quite unlikely to happen. There are also some features in all of the scenario worlds that are likely to occur in Finland, such as the manufacturing of goods for transportation, although they are not explicitly mentioned in the text. The intended goal of the scenario descriptions has been to expand the reader's mindset by including and highlighting "what if", less expected features in the future.

Third, the scenarios have been generated on

scenario blanks with word pairs local – global and scarcity – growth. Neither of the word pairs is unambiguous. For example, we have been quite general in defining what the term local means in specific contexts. The local-scenarios may have different characteristics if local is used to mean a city, region, country (Finland), the Baltic sea region, Northern and Middle Europe, or the whole EU. In addition, the scenarios may have different characteristics depending on what the key driver is for the local business, that is, whether it is voluntary or forced.

Furthermore, we have spoken little about business interactions with the world beyond the local area or how animated that would be. It is hard to imagine a world where trade borders are closed. For example, possible trade volumes of raw materials and commodities across the borders of the local area would have a great impact on the businesses in the scenario worlds.

Moreover, we have not discussed possible specialisations within the local world. For example, the development in the worlds of local scenarios may well lead to a situation where some regions will specialise in the manufacturing of heavy investment goods, such as construction machines, while other regions will specialise in domestic appliances. Some regions may also specialise in manufacturing new products while others will focus on re-manufacturing.

The term global is better defined in the scenario work than the term local, but here too, assumptions have been made. For example, the global scenario worlds are worlds of free trade, which is an assumption that may well prove to be false. Also, the value



chains are assumed to be truly global in the global scenarios, but in actuality, the value chains may well be global, but with a strong local character.

Scarcity is another very loosely defined term in the scenario work. There can be scarcity from materials, money, or skilled workforce or all of them. The influence of scarcity on the business of an SME may have different features depending on what kind of scarcity is in question. Furthermore, the influence will be different depending on how strong the scarcity is; Whether it is a question of large and forced systemic change, or to some extent a voluntary search of alternative solutions.

It is hard to believe, for example, that some critical raw materials, such as mineral oil, will not be available at all. It is more likely that the price of a barrel of oil will be so high that it encourages the search for and implementation of alternative solutions in manufacturing and living. But there can be some raw materials, such as rare earth metals, where the large producers (Russia and China) might simply put heavy restrictions on the export of rare earths, which would lead to a systemic change in Europe. A systemic change may also take place through a collapse of economy or uncontrolled refugee immigration.

Fourth, it is worthwhile to devote a few words to the scenarios' time frame. The scenarios target year is 2025. It is always very difficult in foresight studies to estimate the duration of change from one

regime to another. Systemic changes may be much slower than expected, but they may also be surprising and abrupt, which was the case in the collapse of the Soviet Union. Abrupt changes in business environments may also take place today. We do not know, for example, what kind of changes the migration of refugees will create in regimes across Europe or the world, in general. In this scenario work we have included some possible consequences of the migration in the scenarios, but, definitely, not all possible consequences.

Finally, all four scenarios have a more or less positive base for the future. No worst case catastrophe scenarios were included in the study. However, it is not our intent to say that major catastrophes, such as prolonged war, cannot happen in Finland. Such catastrophic scenarios would result in a state of emergency in the regime, and make the running of normal business difficult. Therefore, they are excluded from the study.

In spite of the "uncertainties" mentioned above in the scenarios, they clearly indicate that it will be possible for a Finnish manufacturing SME to successfully conduct business in each of the potential future world. The models of successful business, however, will not be the same in the different worlds. Therefore, it is important to take a closer look at the similarities and differences in the scenarios from a business perspective.

4.2. SUCCESS FACTORS IN THE SCENARIOS

There are many similarities in the success factors between the scenarios. The role of the factors and the business models where they are implemented, however, may not be the same in the scenarios.

There are a few success factors that appear in each scenario. Effective use of local natural resources and a circular economy are important in each of the scenarios and may give a competitive advantage to the company. In the growth scenarios, these things simply take place on a more voluntary basis than in the scarcity scenarios. Effective implementation of digitalisation at all levels of business, from technology to business processes, is must in each scenario. The competitive advantage of a company has to be built on that.

Maintaining high quality education and knowhow in Finnish society is crucial for the success of Finnish manufacturing SMEs in each scenario. Skilled employees are an essential part in most business models (the skills needed, however, are not the same in each scenario – see below). Co-creation of innovation and new business as well as trust between the actors are important success factors in each scenario.

Manufacturing of high value added products from Finnish raw materials is one of the key success factors for Finnish SMEs in all scenarios. It does not, however, mean that each SME should have an own product and that each SME should use only Finnish raw materials. Successful business can also be conducted as a part of a value chain for

high value products and from imported raw materials. Branding, coupled with the use of Finnish raw materials, may give a special competitive advantage to the manufacturing SME in each scenario.

Then there are success factors that are very characteristics to two scenarios described by the same key word (growth, scarcity, global or local). They may also have an important role in other scenarios, but they can clearly be identified to form the core in one pair of scenarios. For example, focusing on the needs of customers is important in all scenarios, however, in the growth scenarios it is probably the number one success factor. Similarly, efficient use of natural resources is important in each scenario, but it is the strongest characteristic in the scarcity scenarios.

In global scenarios, an SME should focus on niche markets, while in local scenarios it should emphasise its local colour or focus on the replacement of imports. When it comes to skills, the growth scenarios emphasise a high level of focused technological competence, while the scarcity scenarios call for multiple skilled persons. International sales skills are at the core of success factors in the global scenarios, while the creation of local business ecosystems is highlighted in the local scenarios.

In Table 5, three very characteristic factors of success are given for the growth, scarcity, global and local scenario pairs. This table addresses the similarities between the scenarios and, in this way, helps manufacturing SMEs realise a successful future.

Table 5. Characteristic similarities in success factors between the scenarios

Growth scenarios	Global scenarios
<ul style="list-style-type: none"> • Focus on needs of customers • Innovations • High level of focused technological competence 	<ul style="list-style-type: none"> • Focus on specialised (niche) markets • International sales skills • Global value chains and competence clusters
Scarcity scenarios	Local scenarios
<ul style="list-style-type: none"> • Focus on the efficient use of natural resources • Circular economy • Multiple skilled persons 	<ul style="list-style-type: none"> • Focus on local products/replacement of import • Local business ecosystems • Capability to use local raw materials

4.3 EXAMPLES OF BUSINESS MODELS IN THE SCENARIOS

In the workshops of the For Industry scenario work, we spent a lot of time with the representatives of manufacturing SMEs to identify business opportunities in the scenario worlds, and then, sketch business models for creation of successful business to fulfil the identified needs in the business opportunity. Through these exercises, we learned that it will be possible for a Finnish manufacturing SME to conduct successful business in each of the potential future world, but the business models for successful business will not be exactly the same in the different scenarios. Business success factors given in Tables 1–5 are summaries of the workshop discussions.

In the workshops, we identified business opportunities, such as modernisation and management of raw material and waste data, that are very relevant in each scenario. We also identified business opportunities, such as manufacturing of commodities that are currently imported from Asia, that will be of great importance in the local but not the global scenarios. We found a large number of business opportunities and business models, which are currently in use in the Finnish manufacturing industry that will continue to be relevant in future worlds.

Examples of these are manufacturing of automation equipment as well as systems for renewable energy production.

In the sketching of the business models, we focused on four aspects:

1. What is the offering?
2. What are target markets/customers, i.e. to whom?
3. What are required capabilities to produce the offering, i.e. how/with whom?
4. What is the earning logic in the business model (i.e. how to earn money?)

The business model is based on the identified opportunity, and it should take into account, among other things, the scenario specific success factors given in Table 5.

Tables 6–9 give examples of business models for each scenario. These examples were selected to emphasise the special characteristics of the scenario world. Finally, in Table 10 we describe a business model that would work in each scenario. The examples were not selected based on possible profitability of the model or how many Finnish SMEs can use this kind of business model in limited markets. The represented business models

Table 6. Example of a business model in the global – growth scenario

Name of the business model: <i>Optimization of use (systemic product)</i>		
Required capabilities (how/with whom?)	Offering (what?)	Target market/customers (to whom?)
<ul style="list-style-type: none"> • Broad and deep engineering knowledge of the technology in question • Application knowledge • Global SME networks • International sales skills and channels 	<ul style="list-style-type: none"> • Complex production machines and systems • Full turnkey solution for customer problems • Competitive advantage comes from the optimisation of use 	<ul style="list-style-type: none"> • Big manufacturing companies for whom the optimisation of use is not their core knowledge • Small manufacturing companies
Earning logic (how/€?)		
<ul style="list-style-type: none"> • Productive operating hours 		

are described very generally. In reality, a company should define a model in much greater detail.

For the scenario global – growth, we have chosen **Optimisation of use** (systemic product) as an example of a business model for Finnish manufacturing SMEs that can work well in the future world in Table 6. The offering in this business model consists of a turnkey solution for a complex production system combined with system maintenance service. The competitive advantage in the offering comes from the knowledge of how to optimise production system use. Consequently, earnings come according to productive operation hours. In order to be competitive in global markets, the offering must be well focused on highly specialised production systems.

It is clear that a single SME, alone, can hardly supply this kind of offering. Instead, this is a joint offering by a global SME network. Alternatively, this can be an offering by a large actor who has a group of manufacturing SMEs as key partners. In the former case, the opportunities as well as the risks would be higher for an SME than in the latter

case, where the large actor would carry the main business risk but also would retain the majority of the profits.

The sketch of the business model is described in Table 6. The business model Optimisation of use example can also work well in each scenario world provided that the business model is modified to account for the specific characteristics of the scenario world.

Wellbeing has been chosen as an example business model for the scenario world local – growth, Table 7. Here, wellbeing means a symbiosis of wellbeing services and manufacturing industries where the actual offering may consist of automation assisted wellbeing services (human + automation), diagnostics services (equipment + analysis), health data management, etc. Providers of wellbeing services will form the main customer segment for manufacturing SMEs.

Wellbeing is a business model that is specific to the scenario local – growth for two main reasons. First, markets of wellbeing services belong to growth

Table 7. Example of business model in the scenario local – growth

Name of the business model: <i>Wellbeing</i>		
Required capabilities (how/with whom?)	Offering (what?)	Target market/customers (to whom?)
<ul style="list-style-type: none"> • Required capabilities (how/with whom?) • Health care services and technology, FDA processes • Software, digital services • Augmented reality • Design and branding • Tendering terms and conditions 	<ul style="list-style-type: none"> • Wellbeing services + manufacturing industry together • Care robot or automation assisted employee (human + automation) • Service concepts, e.g. diagnostics services (equipment + analysis), health knowledge & data management 	<ul style="list-style-type: none"> • Providers of wellbeing services (business to business) • Public actors <ul style="list-style-type: none"> • Cities • Vocational high schools, universities • Consumers
Earning logic (how/€?)		
<ul style="list-style-type: none"> • Product (equipment) sales • Overall service 		

worlds. People are starting to spend their money on wellbeing services after their basic needs have been satisfied. In the worlds of scarcity, it may be that all the money that people have goes to basic needs (food, accommodation, clothing, transportation, education etc.). Second, in global markets, it is assumed that large multinational actors with massive marketing budgets will dominate the wellbeing business. In the world of local growth, being a small local actor is an asset in itself.

For a manufacturing SME, the business model offers several variants where the role of a manufacturing SME varies from that of a supplier of physical products (care robot, diagnostic equipment etc.) to being the sole supplier of wellbeing services (physical product + analysis, health expertise, data management etc.). The latter variant may produce higher profits for the manufacturing SME than the former business model variant, as the proportion of total value added to the customer is higher. The service model, however, calls for multiple capabilities that may be less familiar to the manufacturing SME, which might significantly prevent the SME from applying the overall service variant of the business model.

Above, we mentioned modernisation as an example of a business model that can work in each scenario. The importance of modernisation, however, is greater in the scarcity scenarios than in the growth scenarios. Here we describe **modernisation** as an example of a business model in the world global – scarcity scenario, where we have highlighted the characteristics of the scenario. In Table 8, modernisation means the continuation of the life of an investment product (or system). The actual offering may mean a variety of things: automation of manual machines, updating the functionality of the product, updating parts or materials of the product, etc.

To be competitive in the modernised business, one must be a top expert in a specific and narrow sector. One must know the machine in its original state, how it can be improved by implementing new technology and materials, which parts of the machine should be updated and replaced, and when it would be the right time to do it, etc. So, although the term modernisation is generic, the actual business must be well focused. That is why it is a suitable business model for an SME. The world of global – scarcity

Table 8. Example of business model in the scenario global – scarcity

Name of the business model: <i>Modernisation</i>		
Required capabilities (how/with whom?)	Offering (what?)	Target market/customers (to whom?)
<ul style="list-style-type: none"> • Service development • Original manufacturer (know-how) • Top experts in narrow sector • Intelligence in products, software, IoT • Liability, responsibilities • International sales channels & SME offering network 	<ul style="list-style-type: none"> • Continuation of life of an investment product or system • Modules of modernisation (e.g. automatization of manual machines, making the machine remote/self-monitored) • Updating the functionality of the product • Updating parts or materials of the product 	<ul style="list-style-type: none"> • End-users of machines • Old factories
Earning logic (how/€?)		
<ul style="list-style-type: none"> • Services, updates • Guarantee of performance 		

offers global markets for the specialised modernisation service as well as a global SME network to support the offering.

The earning logic of modernisation may challenge the service provider (SME) as customers may increasingly want some kind of guarantee based pricing principle (i.e. pricing connected with the guarantee of performance). This would work well from the viewpoint of an SME (the supplier of modernisation) as long as everything goes as planned, but in the case of problems, economical risks may become high. Therefore, the SME should be good in managing the liabilities and responsibilities of business.

In the example of a business model in the scenario world local – scarcity, we focus on the replacement of imports and present a business model **Consumer Products Made in Finland**, Table 9. The offering in the business model covers goods for daily life, such as clothes, shoes, household appliances, hand tools, bikes, etc. These are goods that are more or less essentials for consumers and that used to be imported from abroad (mainly from Asia) during the global business period. In the scenario of local scarcity, these goods must be manufactured

locally, for local markets and by using locally available materials.

For the manufacturing industry in Finland (and in Northern Europe, in general), replacement of imports would mean a significant capability challenge as the old infrastructure for manufacturing these products will have largely disappeared. Accordingly, a new infrastructure, that uses domestic raw materials or circulated components, has to be built. After that, the business model Made in Finland can offer Finnish manufacturing SMEs significant opportunities.

One should, however, take into account the business barrier of the scenario, which is that the price of goods, that are commodities in the 2015 world, would be high in the 2025 world, with respect to the average buying power of citizens. It may cause customers to want to lease many goods in the future that they are currently buying. For a manufacturing SME, the business model of leasing, instead of selling of products they have manufactured, may present a major capital challenge in the world of scarcity. Furthermore, manufacturing SMEs may suffer from poor availability of some materials and components, leading to disruptions in production

Table 9. Example of business model in the local – scarcity scenario

Name of the business model: <i>Consumer product Made in Finland</i>		
Required capabilities (how/with whom?)	Offering (what?)	Target market/customers (to whom?)
<ul style="list-style-type: none"> • Domestic raw-materials (pulp, linen, leather, recycled materials and components) • New industry, rebuilding of the industrial infrastructure • Copying • Sales channels and knowledge of consumer markets 	<ul style="list-style-type: none"> • Goods that are essentials for consumers and that used to be imported (from Asia) • Clothes, shoes, leather products • Household appliances • Hand tools • Vehicles, bikes • Service and repair included 	<ul style="list-style-type: none"> • Local retail dealers • Wholesalers • Housing bodies, cooperatives • Consumers (passing the retailers)
Earning logic (how/€?)		
<ul style="list-style-type: none"> • Product sales • Leasing 		

and business.

The last business model example in the study is **Management of raw material and waste data**, in Table 10. In this business model, a manufacturing SME offers technology and smart solutions for the scrap dealers of the digital era, i.e. dealers that control the flow of raw materials, circulated materials and components, and/or control waste management. The solutions apply technologies such as IoT and Big Data, but they may also include mechanical and automated systems for material and waste separation.

Management of raw material and waste data is a future business model that is relevant in each of the scenarios. In the growth scenarios, the aspect of cost effective waste management is addressed while in the scarcity scenarios the effective circulation and re-use of components dominates the offering. Moreover, in this business model, the earning logic would be quite different when compared to the logic of the €/management system in the traditional sales of systems

Table 10. Example of a relevant business model for each scenario

Name of the business model: <i>Management of raw material and waste data</i>		
Required capabilities (how/with whom?)	Offering (what?)	Target market/customers (to whom?)
<ul style="list-style-type: none"> • IoT, sensor technology • Big Data and data analytics • Automation • Network management • International sales skills (in global scenarios) 	<ul style="list-style-type: none"> • Smart solutions (IoT systems) for the management of raw and circulated materials as well as waste • That is, systems consisting of <ul style="list-style-type: none"> • Sensors • Data management and analytics • Reporting • Automation (mechanical and software) for material and waste separation 	<ul style="list-style-type: none"> • Dealers that control <ul style="list-style-type: none"> • Flow of raw material • Circulated material and components • Waste management
Earning logic (how/€?)		
<ul style="list-style-type: none"> • Sales of management services (€/action or €/month) • Efficiency and savings (€/%) 		



5. Conclusion: How to be successful in the future worlds

All four of the study's potential future worlds are, to some extent, different from our current world of 2015 (i.e. the year when the foresight study was done). Therefore, manufacturing SME business models that are working today, may no longer create successful business in 2025. Accordingly, a manufacturing SME should be prepared for the future, but the question is should how an SME do this?

First, most people tend to think that transformation from one regime to another is a slow process that takes a few decades. If the transformation is mainly driven by landscape factors (see the multi-level perspective model of Figure 2), such as urbanization and aging, the transformation really is a slow process. With slow changes, companies have a goodly amount of time to react to changes and adapt their strategies and business models to meet the requirements of a new regime.

At the niche level of Figure 2, however, there are shock factors, such as various major disasters that may cause an abrupt systemic change from the present regime to a very different one. What happens if the transformations are abrupt?

A manufacturing SME should be strategically ready to rapidly change its business environment and to adapt or change its business model (or models) to fit for the needs of a new regime. History has shown that abrupt changes offer good business opportunities for those who are ready to react rapidly to the changes; while those who are not, lose out in the competition.

To be ready, the company should actively monitor weak or strong signals that indicate a forthcoming

change in the business environment (regime). Active networking with different kinds of technology and business experts, as well as with management of other companies (e.g. SME networks) may help with the monitoring of change signals.

The company should also have strategies ready in place for alternative futures. In addition, plans for a new business model(s) for adapting to the new business environment, should, more or less, be in place. These plans are important for transformation should the change to a new regime be abrupt.

Second, an SME should ensure it has the required competencies for success. Competence requirements in different future worlds may not be the same. As a part of this, it would be beneficial for an SME to be a part of a competence cluster that includes research institutes and other companies. Competence clusters can offer supplementary capabilities for the SME in times of change. They can also be a part of the business model of new offerings in a future world.

The successful business models in the scenarios have some scenario-specific, characteristic, main features. Examples of these are given in Figure 8. These characteristic features can help manufacturing SMEs navigate through times of transformation from one regime to another. However, you should keep in mind that the lists in Figure 8 are far from complete. Examples of characteristic products in the field of clothing industry have been added to the figure in order to highlight differences between the scenarios.

In addition to the SME perspective at the core

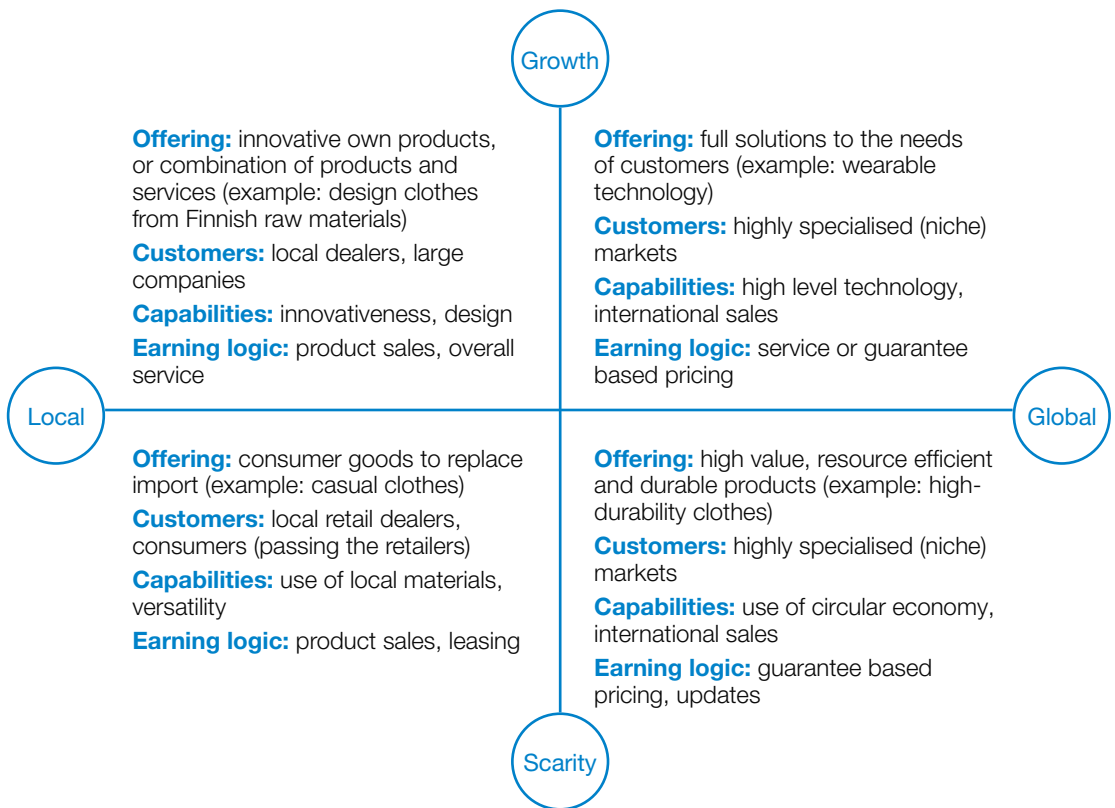


Figure 8. Characteristic features of SME business models in the scenarios

of the study, the study also includes a societal perspective. It would be highly beneficial for the Finnish manufacturing ecosystem that consists of large and small companies, to act as a team – large and small companies doing the same business together. That would strengthen Finnish manufacturing companies' competitiveness in global competition (as well as in the international markets of Northern Europe).

Moreover, the participants in the study unanimously agreed that Finnish government policy should promote innovation and business renewal in order to increase the competitiveness of the Finnish manufacturing industry. Competitiveness in the future worlds will not be possible without investments in innovation and high quality education. The Finnish education system should continue to produce people who have a high level of technical and business competence.

In summary, the study represents four future

scenarios characterised by combinations of the word pairs global – local and growth – scarcity. It may well be that none of the scenarios will happen as they are described in this report. But, the future may well be some kind of a combination of these scenario worlds. In other words, all the scenarios include elements that will take place in the future (at some point).

The target year of the scenarios is 2025, but it may well be that the transition from the current regime to a new one will be a short and abrupt process over a few years or, alternatively, it will be a much slower process than is reported in the scenarios. According to the study, it will be possible for a manufacturing SME to conduct successful business in each of the potential future worlds, but the business models for successful business may not be the same in the different world. Essentially, a company should be prepared for the future.

ANNEX I

Participants in the key workshops of the study

Workshop: Generation of four future worlds, April 13, 2015

Heikki Ailisto, VTT	Jaakko Paasi, VTT
Marko Antila, VTT	Jyrki Poikkimäki, VTT
Tiina Apilo, VTT	Timo Salmi, VTT
Mikael Haag, VTT	Merja Sippola, VTT
Tapio Heikkilä, VTT	Jouko Suokas, VTT
Rauno Heinonen, VTT	Joona Tuovinen, VTT
Juha Kortelainen, VTT	Erja Turunen, VTT
Jani-Mikael Kuusisto, VTT	Nina Wessberg, VTT
Riitta Molarius, VTT	

Workshops: Identification of business models – SME aspect, May 28 and June 2, 2015

Harri Jokinen, Nomet Oy	Timo Salmi, VTT
Juhani Pohjus, General Finland	Magnus Simons, VTT
Kari Sorjonen, Tasowheel Group Oy	Merja Sippola, VTT
Jaakko Paasi, VTT	Nina Wessberg, VTT

Workshop: Identification of business models – Research institute aspect, August 31, 2015

Tiina Apilo, VTT	Anne-Christine Ritschkoff, VTT
Rauno Heinonen, VTT	Iiro Salkari, VTT
Juha Kortelainen, VTT	Timo Salmi, VTT
Risto Kuivanen, VTT	Magnus Simons, VTT
Jani-Mikael Kuusisto, VTT	Merja Sippola, VTT
Riitta Molarius, VTT	Joona Tuovinen, VTT
Jaakko Paasi, VTT	Erja Turunen, VTT
Jyrki Poikkimäki, VTT	Nina Wessberg, VTT

Workshop: Identification of business models – SME aspect of Tampere region, September 2, 2015

Jyrki Auer, MTC Flextek Oy	Erkki Lydén, ELY-Centre of Pirkanmaa
Pasi Kannisto, SKS Toijala Works Oy	Marko Mäkinen, Council of Tampere Region
Reijo Karppinen, Dynaset Oy	Mikko Seppälä, City of Valkeakoski
Antti Kontiainen, ATA Gears Oy	Risto Kuivanen, VTT
Ismo Korhonen, MW-Kehitys Oy	Jaakko Paasi, VTT
Jorma Laitinen, Fintex-Tetrakem Oy	Riitta Molarius, VTT
Jari Ontronen, Jotel Oy	Nina Wessberg, VTT
Tero Sivula, Veljekset Mattila Oy	
Hannu Kivilinna, TAMK	

Workshop: Analysis of generated data, September 21, 2015

Risto Kuivanen, VTT
Jaakko Paasi, VTT
Timo Salmi, VTT
Merja Sippola, VTT
Joonas Tuovinen, VTT
Nina Wessberg, VTT

ANNEX II

List of foresight reports and articles used as input material for the study

- Ahvenainen, M., Heinonen, S. and Hietanen, O. 2010.** Suunnittelu- ja konsulttialan skenaariot 2020. Tulevaisuuden tutkimuskeskus, TUTU-julkaisuja 1/2010.
- Alfredson, E. and Wijkman, A. 2014.** The Inclusive Green Economy. Shaping society to serve sustainability – minor adjustments or a paradigm shift? Mistra, Sweden.
- Ali-Yrkkö, J. 2013.** Mysteeri avautuu. Suomi globaaleissa arvoverkostoissa. Taloustieto Oy, Helsinki.
- ARC Advisory Group. 2014.** The Future of Manufacturing. Scenarios for Investment in Manufacturing through 2050. ARC Strategies.
- DHL Deutsche Post. 2012.** Delivering tomorrow. Logistics 2050. A Scenario Study. ISBN 978-3-920269-54-2.
- Foresight. 2013.** The Future of Manufacturing: A new era of opportunity and challenge for the UK. Project report. The Government Office for Science, London.
- Foxon, T. J., Hammond, G. P. and Pearson, P. J. G. 2010.** Developing transition pathways for a low carbon electricity system in the UK. Technological Forecasting & Social Change 77 (2010), 1203–1213. Elsevier.
- Frost & Sullivan. 2010.** Looking Through the Crystal Ball. Mega Trends That Will Shape the Future of the World.
- IIASA. 2012.** 7 shocks and Finland. Project report.
- KPMG. 2014.** Global Manufacturing Outlook. Performance in the crosshairs.
- López-Gómez, C., McCaffrey, P. and O’Sullivan, E. 2014.** Navigating Complexity in Foresight: Lessons from the UK Future of Manufacturing Project. 5th International Conference on Future-Oriented Technology Analysis (FTA) – Engage today to shape tomorrow, Brussels, 27–28 November 2014.
- Manyika, J., Sinclair, J., Dobbs, R., Strube, G., Rasey, L., Mischke, J., Remes, J., Roxburgh, C., George, K., O’Halloran, D. and Ramaswamy, S. 2012.** Manufacturing the future: The next era of global growth and innovation. McKinsey Global Institute.
- Nikinmaa, T. 2014.** Kone- ja metallituoteteollisuuden visio 2025. ETLA Raportit No 28.
- Popper, R. 2008.** Foresight Methodology. In: Georghiou, L., Cassingena Harper, J., Keenan, M., Miles, I. and Popper, R. (eds.) The Handbook of Technological Foresight. Edward Elgar, Cheltenham, UK.
- Sitra. 2013.** Kohti kestäväää hyvinvointia. Uuden sosioekonomisen yhteiskuntamallin rakennuspuita.
- Teknologiategollisuus. 2014.** Kone- ja metallituoteteollisuuden visio 2025.
- UNIDO 2005.** Technology Foresight Manual. Organization and Methods. Volume 1. <http://www.unido.org/foresight.html>.
- World Economic Forum 2012.** The Future of Manufacturing. Opportunities to drive economic growth.
- Ylä-Jääski, J., Hannus, J. and Laakso J.-P. 2010.** Liiketoiminnan ja teknologian linjaus. Teknologiategollisuuden strategisen menestyksen avaimet – Miten varmistetaan menestys ja kilpailukyky pitkällä jäniteellä. Loppuraportti. Teknologiategollisuus ry and Talent Partners Oy.

KEY WORDS

Foresight, participatory foresight

Foresight is a process involved in systematically attempting to look into the longer-term future with the aim of identifying the strategic areas likely to yield the greatest economic and social benefits. Foresight is the discovery of a common space for open thinking on the future. (UNIDO 2005)

Scenario

Scenarios are visions of future possibilities that have been derived and presented in a systematic way and that strive for some holistic sense of the circumstances in question. (UNIDO 2005)

Manufacturing industry

Manufacturing industry is the branch of manufacture and trade based on the fabrication, processing, or preparation of products from raw materials and commodities (NASA 1996)

Small and medium sized enterprise (SME)

SMEs are defined by the European Commission as having less than 250 persons employed. They should also have an annual turnover of up to EUR 50 million, or a balance sheet total of no more than EUR 43 million (Commission Recommendation of 6 May 2003).

Business model

A business model is an architectural description of how a firm's business runs (Definition used in the For Industry spearhead programme).

Title	Successful business at Finnish manufacturing companies beyond 2020 – Four scenarios
Authors	Jaakko Paasi & Nina Wessberg
Abstract	<p>In order to help the Finnish manufacturing industry prepare for the future, VTT Technical Research Centre of Finland Ltd executed scenario work under its For Industry spearhead programme. The target of the work was to develop scenarios for future ways for Finnish manufacturing companies to conduct successful business beyond 2020. Special emphasis was placed on manufacturing SME business models for 2025. The work was done in collaboration with entrepreneurs and managers of manufacturing SMEs.</p> <p>Four future scenarios were generated using two pairs of key factors that have been identified as shaping the future: global–local and growth–scarcity. This led to the scenarios of 1) global growth, 2) local growth, 3) global scarcity and 4) local scarcity. The global–local word pair refers to manufacturing processes, whether they occur in global or local value chains. The word pair growth–scarcity refers to markets, whether they are driven by economic growth or by the scarcity of raw materials and other resources. All four scenario worlds are, to some extent, different from the world we live in. Therefore, currently used business models may not create successful business in 2025. To help companies prepare for the future, characteristic features of successful business and business models were identified for each scenario.</p> <p>According to the study, it will be possible for a Finnish manufacturing SME to conduct successful business in each of the potential future worlds, but successful business models may not be the same in the different worlds. The transition from the present business environment to a future one may not be a slow process, but an abrupt one, spanning a few years. Thus, companies should be prepared for abrupt changes in their business environment.</p>
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Nimike	Menestyvää liiketoimintaa suomalaisissa valmistavan teollisuuden yrityksissä 2020-luvulla – Neljä skenaariota
Tekijät	Jaakko Paasi & Nina Wessberg
Tiivistelmä	<p>Teknologian tutkimuskeskus VTT Oy on tehnyt For Industry -kärkiohjelmassaan tulevaisuuden ennakoititutkimuksen. Työn tavoitteena oli löytää liiketoimintamalleja ja menestystekijöitä, joita hyödyntämällä suomalainen valmistavan sektorin pk-yritys voi harjoittaa menestyksestä liiketoimintaa 2020-luvulla. Ennakointitutkimus tehtiin yhteistyössä valmistavan teollisuuden pk-yrittäjien ja pk-yritysten johtajien kanssa.</p> <p>Työ tuotti neljä skenaariota, jotka luotiin kahden, kirjallisuustutkimuksen pohjalta tunnistetun, tulevaisuuden liiketoimintaympäristöä kuvaavan avainsanaparin avulla: globaali-lokaali ja kasvu-niukkuus. Sanapari globaali-lokaali viittaa valmistuksen arvoketjuihin: ovatko ne globaaleja vai paikallisia. Sanapari kasvu-niukkuus taas viittaa markkinoihin: onko siellä ajurina taloudellinen kasvu vai raaka-aineiden ym. tuotannon tekijöiden niukkuus. Sanaparien mukaisesti neljä skenaariota ovat 1) globaali kasvu, 2) paikallinen kasvu, 3) globaali niukkuus, 4) paikallinen niukkuus.</p> <p>Kaikki neljä skenaariota kuvaavat mahdollisia tulevaisuuden maailmoja, jotka ovat jollain tapaa erilaisia kuin se, missä me elämme tällä hetkellä. Siksi yritys ei välttämättä menesty näissä tulevaisuuden maailmoissa samoilla liiketoimintamalleilla, joilla se menestyy nyt. Auttaaksemme yrityksiä varautumaan tulevaan tunnistimme kustakin tulevaisuuden maailmasta tyypillisiä tekijöitä ja potentiaalisia liiketoimintamalleja, jotka tukevat yrityksen menestymistä.</p> <p>Tutkimuksen perusteella voi sanoa, että suomalaisen valmistavan sektorin pk-yrityksen on mahdollista menestyä näissä neljässä tulevaisuuden maailmassa. Menestymisen malleissa on kuitenkin huomattavia eroja skenaarioiden välillä. Usein myös ajatellaan, että muutokset tapahtuvat hitaasti. Tämä ei välttämättä pidä paikkaansa, vaan muutos nykyisestä liiketoimintaympäristöstä skenaarioiden kuvaamaan uuteen mahdolliseen todellisuuteen voi olla nopea, muutamassa vuodessa tapahtuva, prosessi. Siksi yrityksen tulisi ajoissa varautua tulevaan.</p>
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VTT For Industry

Successful business at Finnish manufacturing companies beyond 2020 – Four scenarios

VTT Technical Research Centre of Finland Ltd has conducted scenario work under its For Industry spearhead programme in order to support Finnish manufacturing industry to be prepared for the future. The target of the work was to develop scenarios that enable Finnish manufacturing companies to conduct successful business in the future. Special emphasis was placed on business models for manufacturing SMEs beyond 2020. The scenarios are described in this VTT Visions.

Four future scenarios were generated in a participatory foresight process. The scenarios were identified as global-growth, local-growth, global-scarcity, and local-scarcity. Characteristic features of successful business and business models were identified for each scenario. According to the study, it will be possible for a Finnish manufacturing SME to successfully conduct business in each of the potential future worlds, but the successful business models may not be the same in the different worlds.



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