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1 Introduction

There has been an emphasis on using foresight methods mainly in the public sector by the EU or by governments (e.g. FOREN 2001). However, in recent years more attention has also been directed to foresight in business. This action could be called corporate foresight (Cuhls and Johnston 2008, Rohrbeck 2011, Rohrbeck and Gemunden 2011) or strategic foresight (Heger and Rohrbeck 2012, Rohrbeck and Schwarz 2013). The aim of this action can be to create knowledge for the purposes of strategic planning, marketing, organisational change and innovation needs (Cuhls and Johnston 2008, Nash 2013, Ahlqvist et al. 2014). Corporate foresight is future-oriented strategic thinking and knowledge processing.

The study described in this paper was carried out in China in the spring of 2014. The study focused on China's middle and low end business to business markets in the mechanical engineering industry within a 10-year timeframe. The aim of the whole project was to identify ways to serve the future middle- and low-end markets of mechanical engineering industry in China. The study was carried out in cooperation VTT Technical Research Centre of Finland Ltd, FIMECC Ltd and some Finnish mechanical engineering companies interested in the middle-end markets in China. Key research questions were:

- What is the future operating environment in China?
- Who are the manufacturing industry's customers in China in the future?
- What are the future customer needs; what are the functions where needs emerge?
- How to ensure the business continuity by identifying the needs in R & D, support of strategic decision making and investments?
- How to build the future offerings of the Finnish mechanical engineering companies in Chinese markets?

The objective of the paper is to introduce the corporate foresight based method in order to understand future customers and their needs and to discuss the benefits and weaknesses of this method.

The other aim is to understand whether the foresight approach brings something new to traditional market analysis.

2 China as a market area for Finnish companies

Over fifteen years ago, companies in the Finnish mechanical engineering industry began entering the Chinese market. The main reason for their entry was the low costs. Then the companies' main market areas were located primarily in western countries, the EU countries, the US, and Russia. China was seen mainly as a low-cost manufacturing place. After the crisis in the global economy in 2008, the reason for Chinese locations and entries has changed. Nowadays, Finnish companies locate and enter the Chinese market because of its markets and customers. Over the last few years, Finnish companies have been opening R&D centres in China, and some large companies have moved management teams of business units to China. This trend means that companies must acquire a better and deeper understanding of the Chinese business environment and its changes, and also react to these changes.

China is one of the important market areas for Finnish mechanical engineering companies. China was Finland's fourth biggest trade partner in 2012; the value of this trade was about 7 billion euros. About 300 Finnish companies operate in China, and they employ about 70 000 employees. Finnish companies have investments in China of about 10 billion euros.

Typical Finnish mechanical engineering companies operate in a high-end market. However, the most interesting market areas for mechanical engineering companies are the Chinese middle- and low-end markets, which are growing very fast. Companies who are operating mainly in the high-end market have difficulties in developing products for the middle- and low-end markets. They all have knowledge and know-how about what they need, but usually they make use of technology and solutions that are too expensive, or customers do not appreciate or do not need all the features of the products.

3 The method

The foresight-based study was made using a method which included three phases: PESTEV analysis, interviews and workshops, as illustrated in Figure 1. The interview frame was created based on the PESTEV viewpoints: Political, Economic, Social, Technological, Environmental and Values. The PESTEV analysis produced the interview frame.

The method based on three main pillars:

- 1) PESTEV-analysis,**
- 2) interviews and**
- 3) workshops.**

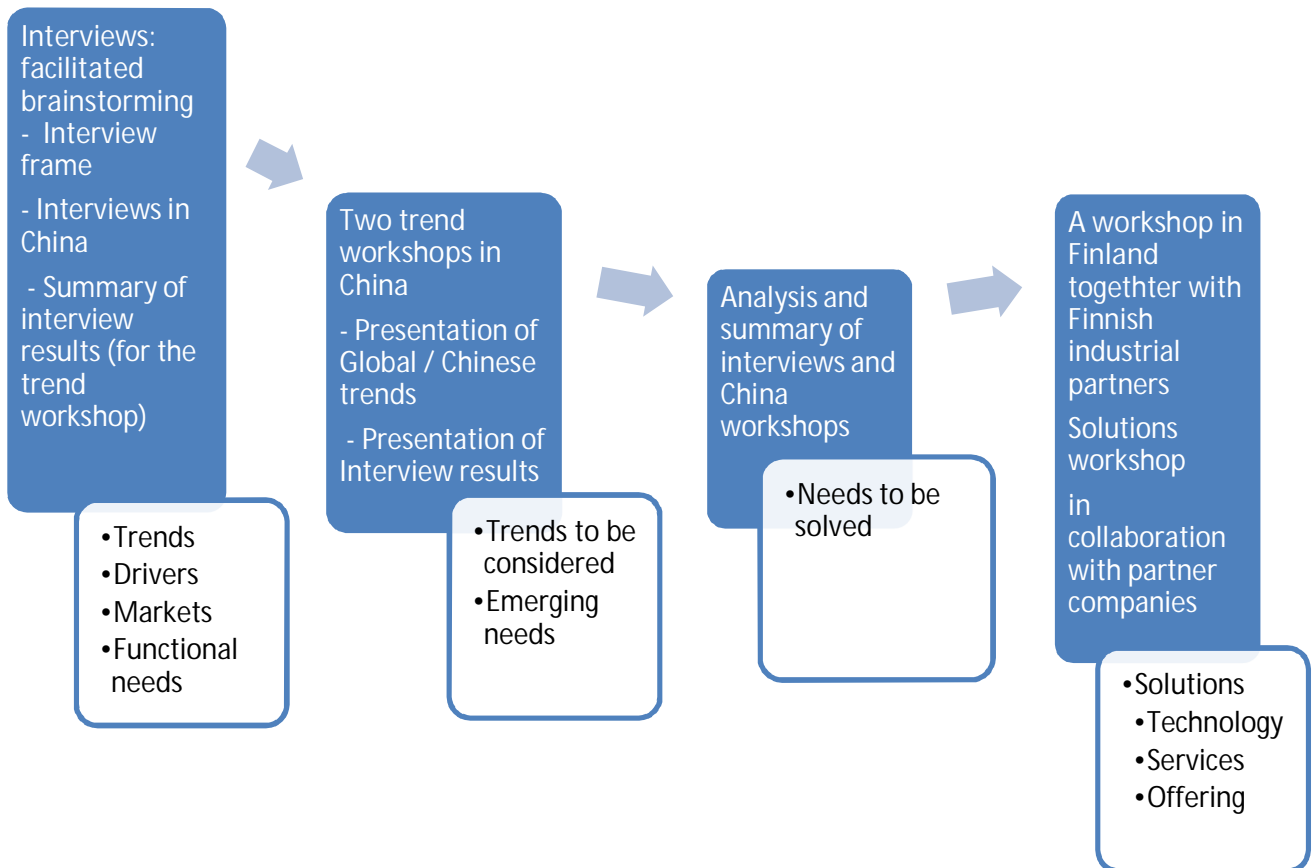


Figure 1. Implementation of the foresight process.

For the study, around 50 companies, universities, institutes, associations, government departments and investors were interviewed. The interviews were carried out from January to March 2014 by Finpro Shanghai Office, China Materialia Co. Ltd and VTT Technical Research Centre of Finland Ltd. Interviews were conducted by Chinese interviewers according to a template prepared by VTT. The interviews were thematic discussions where the future markets were looked at from the view of policy, economy, society, technology, the environment and values. The aim of the interviews was to discover trends and needs in the local Chinese operating environment. The interviews also added to the understanding of the drivers and markets of mechanical engineering in China.

The interviews were carried out in two phases. The first phase contained specialists, such as universities, institutes, government departments, associations and investors. In the second phase, the key persons of local companies were interviewed. In the first phase, 19 organisations were interviewed, and in the second phase, 30 companies.

The PESTEV frame supported the systematic consideration of all the important relevant developments in the operating market environment. In order to gain an insight into the future aspects, the interviewer asked the interviewee to think about all these aspects in the five and in ten year time frame.

In addition to the interviews, workshops were also arranged in China. The first workshop was organised in Shanghai in November 2013. The tentative results of the first interviews were discussed there. The second workshop was organised in March 2014 in Shanghai. In the second workshop, the results of the interviews were discussed more thoroughly.

The third workshop was organised in Finland in March 2014. The goal of the workshop was to define the available technologies and to find solutions to fulfil the customer demands identified in the interviews and workshops. Participants in this third workshop were the industrial parties of the project.

4 The interview frame

The interview frame was designed by foresight experts based on the PESTEV keywords which were worked out to frame relevant questions for the interviewer. For instance, on policy aspects the interviewer asked: What are the main policy trends and their meaning in practice (from the interviewee's point of view) now, in five years and in ten years ahead? Are there any specific local trends in mechanical engineering? How are regulations developed? On economic aspects, the interview discussion was directed at the aspects in global markets, economic depression, taxation, extent of value added, value of brands and industrial infrastructure. Also, modes of operating and production costs were discussed, e.g. logistics, networking, management systems, supply chains and production philosophies, or energy, raw material and labour prices.

The interviewee was encouraged to think about PESTEV aspects related to their own operating environment, preferably based on their own experience and not just based on commonly available and written general outlooks, etc.

The challenge was to acquire information about the hidden trends and tacit needs and functionalities needed: how things actually work or could be done, and the related tools, equipment and services needed.

On societal and demographical trends, the discussion was directed to aging, health and safety, urbanisation, community structure, gender issues, education, communication, immigration, nutrition, housing and transport. Technological trends focused on emerging technologies such as internet of things (IoT), tags, 3D design and operation, 3D printing, nano-technology, bioeconomic solutions, robotics, automation, unmanned vehicles, remote control, e-engineering, intelligent solutions, miniaturization, augmented reality, enzymes, new energy production technologies (solar, wind, hydrogen, biomass), rapid prototyping, new materials and LED technology.

Environmental aspects were discussed in themes such as water management (clean water, waste water, process water, etc.), raw materials, scarcity, recycling, energy efficiency, life cycle strategies (life cycles of the products, designing of the product life cycles, maintenance vs. buying new products), emissions, odours, noise (control), vibration (control), relationships with environmental organisations (NGOs) and local stakeholders, environmental reporting and ecological footprints. The final theme was about values. They were discussed by asking the interviewee to think about social responsibility and ways of life, e.g. degrowth or down sourcing and downshifting.

5 Interview output: the interview template

The results of the interviews were reported in the form of a table (see Table 1). While discussing trends, the interviewer encouraged the interviewee to identify the functionalities needed based on the trends.

Table 1. The interview template: Trends and drivers, functional needs.

Trends/drivers/functional needs	2013 (current)	2018 (5 years)	2023 (10 years)
Policy			
Economy			
Society and demography			
Technology			
Environment			
Values			

6 Results of the study

This study has confirmed the understanding that the middle- and low-end sector of the mechanical engineering industry in China is the fastest increasing market area in the world. According to interviews, the growth rate is over 10% per year in the middle-market sector.

Business models in the middle-end market

Chinese middle- and low-end markets are local, huge and heterogenous. According to the interviews, at the moment the Chinese companies dominate in the middle- and low-end markets, but almost all global players are interested in the markets. Customer needs in the market are totally different than in high-end markets. Customers are not ready to pay for the latest technology solutions. They appreciate and need solutions which are practical and cheap, and where the repayment period is competitive.

Pricing strategy

The most important competition factor is price. In the middle-end market sector, the price of the products must be 20 to 50% cheaper than in the high-end markets. At the same time, the product life time, quality level and productivity cannot be as long or high as in the high-end sector; see Figure 2.

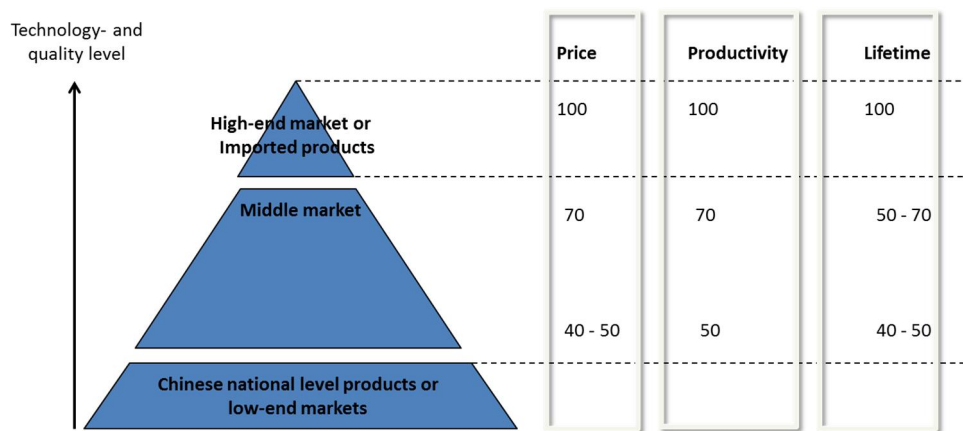


Figure 2. Margins for success in the market.

Customers of middle-end markets are not ready to pay the price of the latest technological solutions, and in most cases they do not need the latest solutions. In the tower crane business for middle-end products, prices must be 20 to 25% cheaper than for high-end products. For example, for a 63-ton tower crane the price level is around RMB 400 000 (around €60 000).

Clean tech and safety sectors

The clean tech sector is the most important and interesting business sector in China at the moment. China produces about 70% of its energy from coal. This is one of the main reasons for the massive air pollution problems. Next are some business opportunities in the clean tech sector.

- A cheap and simple combustion gas cleaning solution, which can clean the coal power combustion gases and cut discharge by half.
- New energy and heating solutions for urban or rural districts.

Some interviewers also pointed out the meaning of safety and investments in safety issues. The development needs in this sector are also huge, if Chinese industry is willing to invest in it.

Automation and robotic solutions

The main segment of the robotics industry is industrial robots, such as in automated workshops in car manufacturing. Now the markets are dominated by foreign suppliers, mainly Japanese companies. Middle-end robots are the big trend for China at the moment. Simple and repeated operations in manufacturing will be replaced by robots in the next 5 to 10 years. A calculation is that one robot costs RMB 200,000 (around €30 000), which will be returned in two years, and the maintenance cost is very low.

Operating in the middle market sector

The middle markets are the local markets in China, and rules are different from those in the high-end sector.

- Customer needs must be known very well, and one must know what kind of characteristics customers are ready to pay for
- The products must be designed for the middle market; in practise; this means that the company must base its R&D activities locally
- Service business is very important for the Chinese customer, and reaction times to customer needs are very short, for example technical support must work locally

Air quality, water and land pollution will be the top trends in China in the future.

Economic environment is focused on sustainability, not on growth.

Technological highlights are in clean tech, moving machines, automation, robots and remote control.

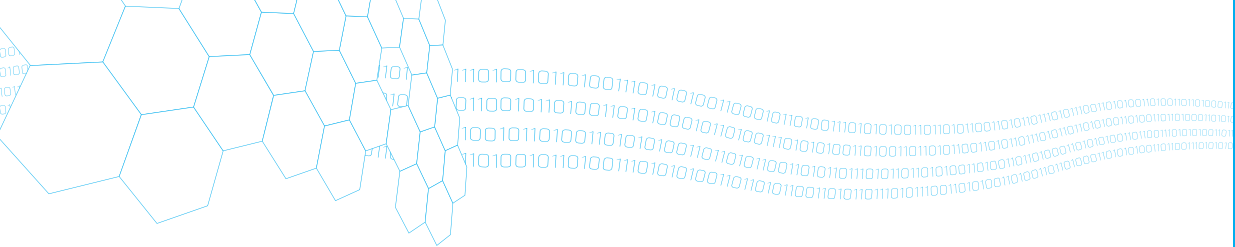
7 Lessons learned

The foresight frame that was used in this study has proved itself to be useful. However, it is challenging to find skilled local interviewers to perform the stakeholder interviews. The cultural differences were not thoroughly tackled, and the deep Chinese values and societal implications were not quite revealed in the study. The study, however, showed that the foresight approach, where the corporate market analysis is conducted starting from the trend analysis, is beneficial and created results that are interesting for the business and market creation.

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