Results of the Skills Technology Foresight of Metal Processing Support Industries in Socialist Republic of Vietnam

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2015

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Introduction

Skills Technology Foresight application context

This document represents the results of the Skills technology foresight session for identifying future skills needs for the metal processing support industries sector in Vietnam. The foresight session was conducted in the framework of ILO and Moscow School of Management SKOLKOVO collaborative project, aimed at developing Skills Technology Foresight to forecast future demands for knowledge and skills of workers in rapidly developing sectors.

Metal processing support industries sector for Skill Technology Foresight implementation was chosen by Republican Ministry of Labour. Criteria, recommended by ILO and experts of Moscow School of Management SKOLKOVO, were:

- High export potential;
- Substantial impact on the country's economic growth and development (at the moment sector plays a significant role in national economy or grows rapidly and has a perspective to become significant);
- High R&D expenses of production or sufficient potential of increasing complexity through technology(including technological modernization);
- The sector should have one or several significant employers (industrial producers, research institutes, etc.) in order to provide substantial workforce demand.

Principles of the road map development

Creation of road maps for certain field of activity is one of the most important humanitarian technology of modern innovative economics. In the situations, when future is fundamentally unpredictable and unmanageable, such maps become “futures navigators”, allowing participants to see and understand what other participants can do and to what consequences it will lead.

The road map is a combination of forecast about the most likely future and actions of key interested parties. It’s not a route of movement, but an objective description of the space of the future, which is necessary for socio-economic planning.

All over the world such road maps underlie strategic plans of big companies, non-profit organizations and governmental bodies, because this instrument allows to consider variants of succession of future events, reveal points of uncertainty and tension and offer probable decisions.

Key principles of the road map development are:

- Future depends on applied efforts, it can be created;
- Future is variative — it doesn’t result from the past, but depends on the decisions of participants and stakeholders;
- There are fields you can make forecasts about, but in general future can’t be predicted for certain, so we can prepare for it or make the future we want to see.

General skills technology foresight framework

The STF process is made through the series of sequential steps that can help derive the necessary information:

1. TRENDS: The process has to begin with the analysis of needs of consumers and stakeholders that drive the development of the industry / sector. These needs are reflected in trends that shape the industry's future that should include (though should not be limited to) the following types of processes:

- *changes in the consumer demand* due to changing consumer expectations and preferences (e.g. growing demand for healthy and organic food in the food processing industry);
- *changes in domestic and global industrial production standards* (e.g. increasing application of environment-friendly operations);
- *changes in the industry resource base* that may constrain the development of the industry (e.g. increasing average workforce age);
- *general changes in the economy* that induce new working practices (e.g. intensified application of digital technologies that leads to wide application of remote workforce).

These trends present opportunities for new market niches and threats to existing business models that dominate the industry – that will require response from the industry.

2. TECHNOLOGIES: The industry responds to opportunities and threats by adopting new hard technologies (e.g. the new equipment, or the production process, etc.) and soft technologies (e.g. the new business models, or the management process, etc.). The applicability of these technologies is constrained or enabled by factors such as:

- *planned investment* of key business players or the government into the technology development or transfer;
- *availability of infrastructure* that enables the technology: e.g. modern software sector requires both the reliable supply of electricity and sufficiently good telecommunication networks that allow Internet communication;
- *industrial policies*, e.g. environmental tax liabilities that allow adoption of alternative energy sources;
- *cultural and social barriers to adoption*: e.g. religious considerations can constrain the use of computers, or highly authoritarian corporate cultures can constrain the application of participatory leadership formats.

Since adoption of technologies is a response to challenges posed by trends, the response time should be taken into the account. This is an important consideration even in case of technology transfer (as technologies have to be identified, licensed, installed and adopted through the industry learning), but even more so in case of technological innovation – the time lapse between research, prototype development, product development, early adoption and mass-scale application can be significant. The technology-driven demand for skills becomes evident (and requires the provision of new education and training) only when new technologies become widespread (e.g. when they are applied by at least 10-20% of industry enterprises).

It should also be noted that adoption of specific technologies in the sector may require the adoption of derivative or complimentary technologies in related sectors (e.g. technologies of suppliers or infrastructure providers). For instance, adoption of tractors and other heavy agricultural equipment requires servicing and fueling stations (i.e. the response from complimentary sectors that enable the application of a technology).

3. WORK TASKS: Based on the list of technologies that industry seeks to apply, it is possible to define the list of necessary work tasks to be performed by employees. Some of these work tasks will be shaped as new occupations (e.g. wider use of domestic robotics will require workers specialized on developing or serving these robots), while the majority of these tasks will be to the existing workforce and will redefine the scope of their responsibility (e.g. the use of genetically modified crops does not necessarily imply new occupations in the agricultural sector, but it may require existing workers to use different procedures that help grow these crops).

Apart from that, some technologies may redefine not only the individual work tasks but working environments. For instance, wider application of computers may enable electronic document turnover which will require all workers to track their operations with the use of digital equipment – and it may also enable some workforce to work remotely. Moreover, in some cases, working environments scenarios can redefine the individual work tasks: e.g. the implementation of cyberphysical production systems in developed industrialized countries can imply working environments that will lead to either simplification or to sophistication of work tasks (depending on the extent to which employees will be required to control and reprogram the self-maintained robotic production lines).

4. SKILLS DEMAND: Based on the changing work tasks and working environments, it is possible to define the skills demand in the sector. The existing skill base in the industry should be compared to the skills that are required, and following types of skills should be identified:

- *new skills* defined by work tasks that cannot be performed with the existing skill base (e.g. application of neural implants in medical industry requires special training of neurosurgeons and supporting specialists such as nurses);
- *obsolete skills*: some skills in the sector can be rendered obsolete by the application of new technologies – e.g. wide application of tractors and trucks in rural South-East Asia has made the elephant transportation (and, consequently, elephant breeding) almost non-existent. Worth saying, the phasing out of obsolete technologies occurs gradually, so the time should be taken into consideration while obsolete skills are still necessary because older technologies are still applied;
- *skills with changing scope of application*: some technologies, either hard or soft ones, may change the scope of application of certain skills, for instance, turning them from specialized into general sectorial skills (e.g. wider application of recycling and reuse practices in the industry may require that every worker in the industry is aware of, and applies, resource-saving practices).

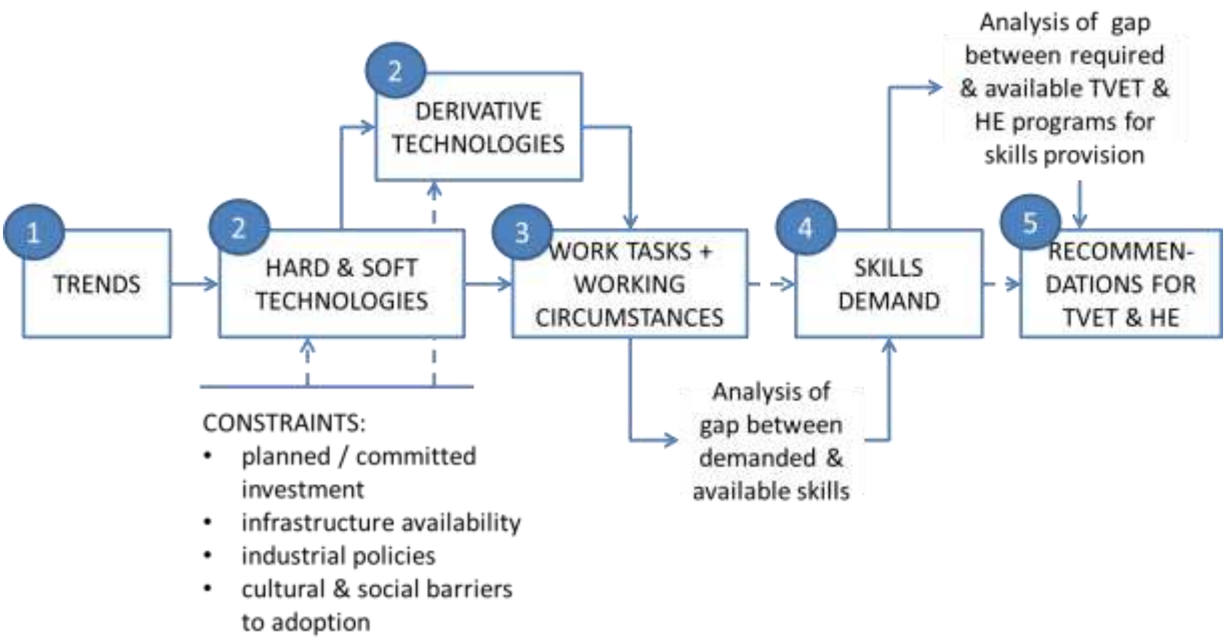
The skills can be identified with particular focus to

- workers, technical personnel (e.g. engineers), management, and self-employed specialists;
- new occupations (what new types of jobs will emerge in the industry) or existing occupations (change of work tasks and skills required from existing jobs);
- large enterprises or small / medium enterprises (including companies working in the informal sector).

5. RECOMMENDATIONS: Based on the identification of skills demanded, a set of recommendations can be developed for different stakeholders that can influence the provision of these skills. The most important of these is the *TVET and HE system*. Recommendations can be based on the analysis of gaps between skills required by the sector and educational and training programmes performed by TVET and HE providers. Once the gaps are identified, it is possible to develop the programmes of changes required in the curriculum and education format to serve the future skill needs better.

Apart from changes that can be implemented at the TVET and HE system level, some changes may be required from the *policy-makers*. For instance, sometimes the skills gap cannot be closed by local providers due to lack in the education and training system itself, and the government can help train education providers internationally, or otherwise encourage the international exchange of skills.

It is also possible that *stakeholders from within the sector labour market* (such as employers or trade unions) contribute to the skill base development. One of the most obvious ways to improve the skill base is on-job training and internship opportunities provided by the sector employers. Leading employers can also collaborate to develop training programmes for the sector. These opportunities should be addressed during the STF session – since employers are the key beneficiaries of efforts to improve the sectorial skill base, they can also actively contribute to this improvement.

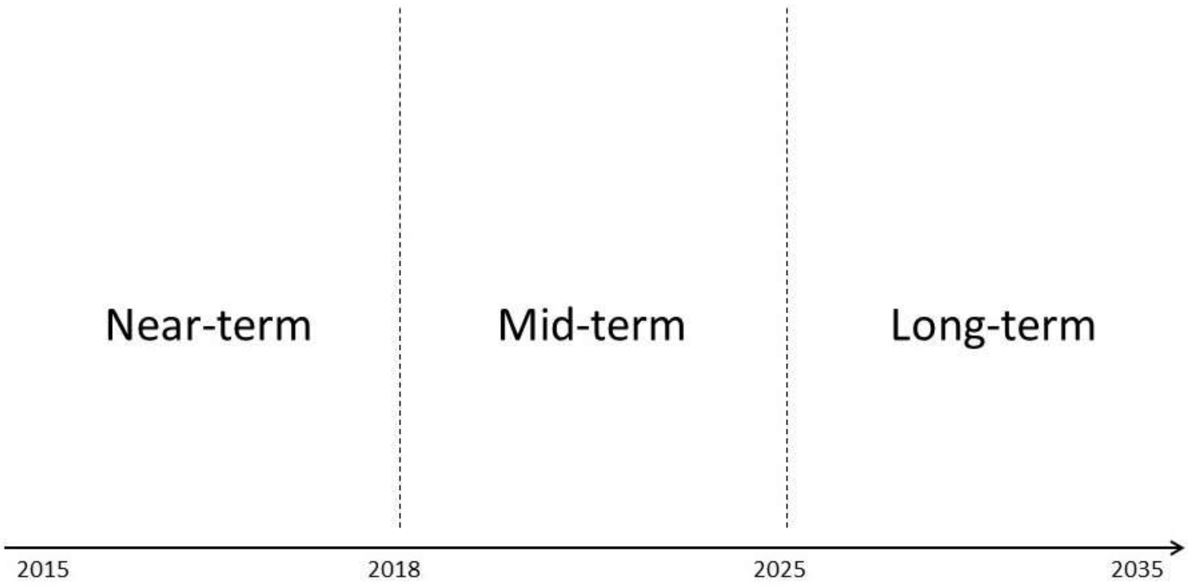


Time horizons

The skills technology foresight considers changes that may happen some time into the industry future. As we discussed above, the industry requires certain time to response to changing consumer and stakeholder needs through adoption of new technologies. Apart from that, the TVET and HE system requires certain time to response to changing skill demand, even if this demand is presented immediately. For instance, taking into account the time required to revise educational programmes, and the education cycle itself, the earliest when new technological specialists can be brought into the industry from the higher education system is between three and five years. This cycle is shorter for workers trained in TVET system (but still would be at least between two and three years). Training for specific skills, however, can be introduced on shorter timespans (e.g. courses can be created even within the annual cycle if the need is pressing).

The discussion of industrial trends (and projects / plans to be implemented by key industry players), technologies that can be adopted by the industry, and changes that can be made in the TVET and HE sector to accommodate the demand for new skills, can be made across three time horizons:

- *near-term* (typically, between now and 2-3 years from now, but sometimes longer, depending on industry's technology lifecycle) is the horizon where things are more or less defined by processes already in use and projects already being implemented, and where only short-term improvements in technologies and training can be made;
- *mid-term* (typically, between 3 and 7-8 years from now) is the horizon where most industries define their strategic objectives, where noticeable changes can be made to industrial technology practices, and where TVET and HE system can adopt new education and training programmes to match future skills demand;
- *long-term* (typically, between 7-8 and 20 years from now) is the horizon where long-term 'vision of the sector' is formed, and where certain technologies can substantially disrupt the existing industry's practices. While this horizon is too far for the TVET and HE system to be taken into consideration for specific education and training programmes, it can be used to identify the 'direction for transformation' (e.g. if the sector expects to actively use the digital technologies or robotics in the long-term, respective training for engineers can be embedded into educational programmes).



Metal Processing Support Industries Sector in Viet Nam

1. Foresight session prerequisites

Supporting industries (SI) are those producing materials, parts and components, accessories, semi-products to supply to manufacturing/assembling industries producing final goods as means of production or consumption goods. The term was developed by Japanese investors: SI are understood as foreign or local manufacturing firms that supply parts and components to mechanical manufacturing industries assembling automobiles, motorbikes, electronics and other mechanical products, are key industries for strengthening domestic industrial capability. Japanese researchers and businesses also understand supporting industries as supply industry in some sectors including automobile, motorbike, electronics while these industries are understood in wider scope including mechanical manufacturing industries as well as processing industries including garment and footwear in Viet Nam. Unfortunately, currently, the country does not provide the statistics for SI separately but includes in the downstream mechanical industries. This difficulty also causes confusion for business registration since some SI products do not belong to the industry. For example, the metal components for Samsung mobile phone are not included in the electronics industry.

Regarding the capability of supporting industry firms, several surveys were conducted by local and international organizations to grasp situation of supporting industries in Viet Nam. Due to the characteristics of growth and the regulations of the Vietnam Goverment about localization and the large capacity of supply in the downstream market, the supporting industry for the motor bike industry has grown rapidly in country. Products of Honda, Yamaha and VMEP, including most of the component details, are manufactured locally. Because of the market capacity, assembly enterprises are encouraged to invest in Viet Nam. According to the Ministry of Industry and Trade (MOIT), the rate of localization has reached 95 percent. However, the supporting industries for other down-stream sector are lower (Table 2), the local content for Agriculture Industry is 40-50%, Industrial Industry is 25-35%, Automobile is 15-40%. The metal components meet 85-90% of demand for motorcycles the production; 15-40 % of the demand for automotive production (depending on vehicle type); and about 60 % for the manufacture of agricultural machinery.

Table 2: Local content of down-stream industries in Viet Nam[1].

Down-stream industries	Local content
Motorcycles	85-95%
Automobile	15-40%
Agriculture Industry	40-50%
Industrial Industry	25-35%

Source: MOIT, 2014

According to these surveys, Vietnam's supporting industries in general has been developing, but mainly are operated by foreign enterprises. Local enterprises also can join supply chains, but mostly in second or third tiers. Most of firms in the first tier of motorbike supply chains are Japanese and Taiwanese firms. In addition, raw materials for making parts and components are imported, thus competitiveness of Vietnam's supporting industries in terms of cost and delivery is relatively low.

[1]MOIT (2014), Master plan on the Supporting Industries in Viet Nam to 2020 vision to 2030

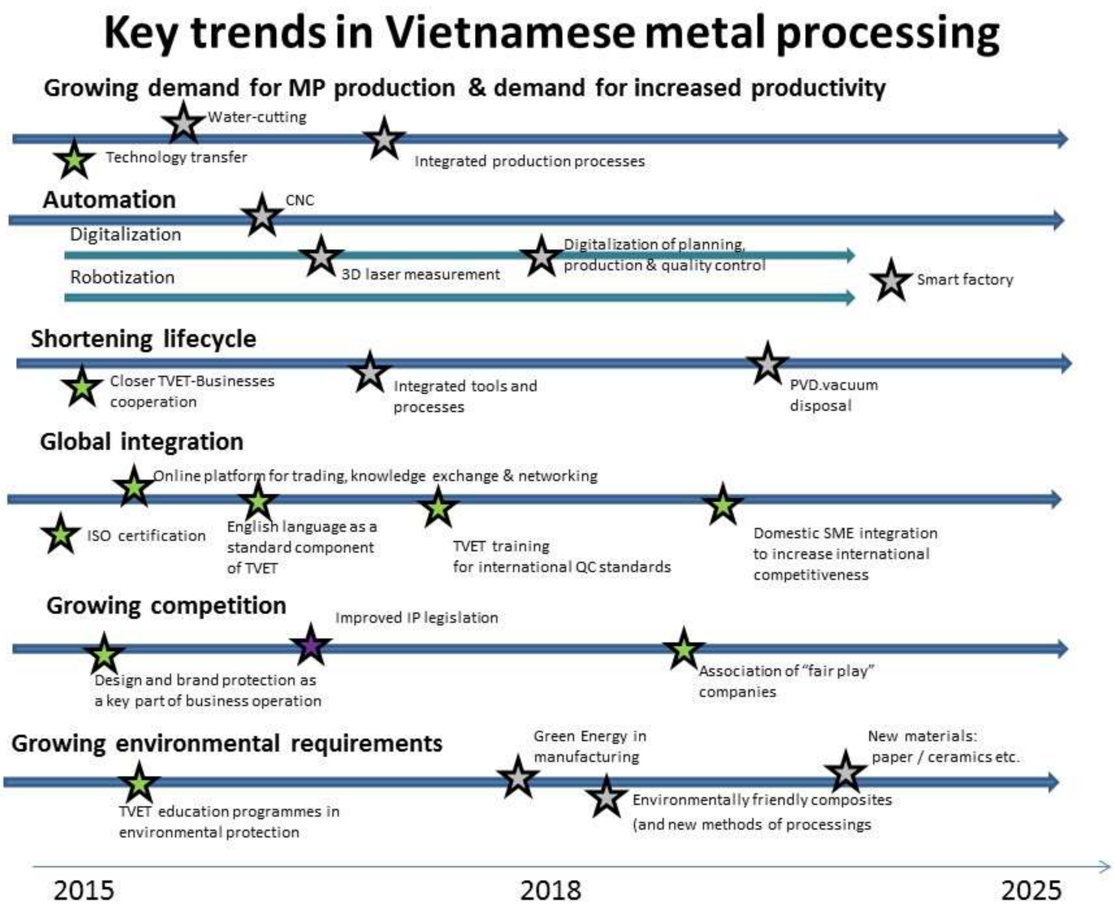
Working sessions focusing on identifying future skills needs for the metal processing support industries sector in Vietnam took place December 11-15, 2014. The first two days were focusing on

a) Analysis of key trends which drive change in the sector, and discussion of new 'hard' technologies (i.e. new equipment, production processes etc.) and 'soft' technologies (i.e. new managerial methods, new organizational formats etc.) resulting from the trends. These 'factors of the future' were analyzed across three time horizons: short-term (next three years: 2012 to 2015), mid-term (the following five years: 2015 to 2020), long-term (the following decade: 2020 to 2030). Around 12 to 15 key trends and soft technologies, and around 15 to 20 new 'hard' technologies were identified during this discussion.
b) Analysis of new market opportunities (products and services) and threats caused by trends and new technologies. Identification of changes in working tasks due to evolving industry technologies, new opportunities and new threats the industry has to deal with.
c) Identification of working tasks which: (i) are similar to existing working tasks (capable of being resolved with existing skills and knowledge), (ii) become obsolete due to technology change and industry context, and (iii) emerge due to changing industry context. Working tasks were identified for intellectual and manual labour.

The main object of the analysis was the typical metal processing company. Key profiles for production, quality control and supporting activities were analyzed and number of project initiatives for redesigning current workers training system (including TVET) were elaborated.

In the course of the other days the map was verified and amendments to the proposals were made.

2. Market trends analysis



What are the key processes in the metal processing industry? What technologies and products will appear in 5-10 years? The participants of the session discussed the trends and selected the most important of them, which will influence the future of the industry the most.

2.1 Key trends

Key technological, social and market trends influencing the metal processing industry.

a. Growing demand for MP production & demand for increased productivity. 2015 →

The market volume is essential for the development of supporting industries and the metal processing supports industry. For the last years the country saw increasing demand in all the down-stream sectors.

In motorbike sector, Vietnam's demand in 2011 reached 3 million units, surpassing Thailand to become the second largest motorbike producer in ASEAN region, came after Indonesia. Meanwhile, previous studies indicated that suppliers could set up factories in Vietnam with an annum order of 200,000 to 300,000 units. Having such large market volume, Vietnam currently becomes the fifth largest motorbike assembler in the world, with local procurement rate of 70-90%, and motorbike makers are expanding their production for export to other countries in the region, Africa, and Latin America

Vietnam's electronic industry has developed drastically in the past few years, attracted investment from large firms such as Samsung, LG, Intel, Cannon, Fujitsu. Nevertheless, these firms invested with large volume of capital their mainly aims are to utilize land and labour force of Vietnam.

Hard and soft technologies appearing on the trend (as forecasted by the foresight session participants):

2015. Massive use of the technology transfer. The technology transfer is critical for the industry's development. Although there're several institutions working with the transfer of the advanced technologies (including the school of Materials Science and Engineering (SMSE); the second school of Mechanical engineering; Institute of Materials Science – IMS) there's clear understanding that the country should focus on this processes.

2016. Water-cutting technologies. A water-cutting, also known as a water jet, is an industrial tool capable of cutting a wide variety of materials using a very high-pressure jet of water, or a mixture of water and an abrasive substance. Water-cutting is often used during fabrication of machine parts. It is the preferred method when the materials being cut are sensitive to the high temperatures generated by other methods. An important benefit of the water jet is the ability to cut material without interfering with its inherent structure, as there is no "heat-affected zone". Minimizing the effects of heat allows metals to be cut without harming or changing intrinsic properties. Water cutters are also capable of producing intricate cuts in material. With specialized software and 3-D machining heads, complex shapes can be produced.

2017. Integrated production processes. Vertically integrated in-house production systems that, unlike fabless and foundry manufacturers, are not easily affected by external factors are considered by local experts as an important element to implement in the industry.

b. Automation. 2015 →

According to analytical reports, the $152 billion global industrial automation market has grown 6 percent a year, on average, since 2003, which is nearly twice as fast as overall industrial production. This means that Vietnam industries will face this trend as well and should be thoroughly prepared to the challenges it incurs. According to analytical report, currently Vietnam metal processing companies are facing lack of automatic equipment in most production processes – only in welding the automatic or semi-automatic technologies are widely used.

As part of this trend two sub-trends were mentioned:

1. Digitalization. As well as improved networking of modelling activities' content, the linking between digital planning and production is given a high priority in the future. In this case, concepts and solutions are being sought, such as adjustments and changes which take place in real factory operations, to be incorporated into digital models of production planning.
2. Robotization. From 2015 to 2017, robot installations are estimated to increase by 12% on average per year: about 6% in the Americas as well as in Europe, and about 16% in Asia/Australia. The trend towards automation continues to increase the volume of robot installations.

Hard and soft technologies appearing on the trend (as forecasted by the foresight session participants):

2016. Massive use of Computerized and Numerically Controlled (CNC) equipment in the production. Growing requirement to the productivity and quality of the industry's production makes using of CNC equipment a-must in the nearest future.

2017. Massive use of 3D-laser measurement technologies. Application of such technologies permits high-precision 3D measurement, imaging and comparison of parts and compound structures within production and quality assurance processes. It can be used for inspecting components and assemblies, production planning, documenting large volume spaces or structures in 3D.

2018. Digitalization of planning, production and quality control.

2023. Smart factory. The participants of the foresight session believe that by 2023 Vietnam will see full-scale facilities where the real manufacturing world is converging with the digital manufacturing world to enable organizations to digitally plan and project the entire lifecycle of products and production facilities. All equipment on a smart factory will communicate through the Web, producing fully customized production.

c. Shortening lifecycle. 2015 →

One of the most profound changes in the last decade is the dramatic shrinkage of product life cycles. The shortening of life cycles means that replacing a product or service line every two years is becoming the norm across many industries. Furthermore, if a business is not quick to introduce a product to market, it risks launching goods that have already been superseded by competitors. This changing environment means that accurate demand planning and forecasting has never been more imperative, and businesses must take a more coordinated approach to supply chain management.

Hard and soft technologies appearing on the trend (as forecasted by the foresight session participants):

2015. Closer TVET-Businesses cooperation. One of the main problems in the existing system of training is gap between skills that were trained in colleges and that are needed in companies. The problem of the skills gap that exists between graduates and the work that needs to be done is common for the entire world. According to Gallup survey only 11 percent of business leaders strongly agree that graduates have the necessary skills and competencies to succeed in the workplace. That's in contrast to another survey, conducted by Inside Higher Ed in conjunction with Gallup, indicating that 96 percent of academic officers believe that they're effectively preparing students for success in the workplace. One of the most critical steps to close this gap is to establish close cooperation between TVET system as a provider of the new workforce and businesses, which hire graduates.

2017. Integrated tools and processes. Another way to cope with fast changing demand is to created integrated tools and flexible processes, which will allow company quickly respond to the changes in customers' requirements, new technologies etc.

d. Global integration. 2015 →

The process of international integration has been evolving since mid-1980s and continues today. According to the analytical report in the period of 2006 to 2010, Viet Nam mechanical industry achieved great success. The country won many large export contracts. It opened a new step when Viet Nam became a WTO member.

Hard and soft technologies appearing on the trend (as forecasted by the foresight session participants):

2015. ISO certification. Currently there are quite a few ISO certified companies in Vietnam and it causes serious difficulties with participation in international contracts. Foresight session participants indicated that the increased focus on ISO certification is necessary in the nearest future.

2016. Online platform for trading, knowledge exchange and networking. Participants of the foresight session offered to create specialized industry online platform (comparing it with AliBaba.com) which would help them not only to sell their production more effectively but also to establish networking process and exchange expertise with colleagues.

2017. English language becomes standard component of Vietnam TVET system. Participants of the working sessions agreed that today graduates rarely know English, and this causes difficulties for small- and medium-sized companies to interact with international customers or partners.

2017. TVET training for international quality control standards. It was specifically noted that current workers do not have expertise in international quality control standards. At the same time, these standards are becoming critical in the global open world and international customers often require the QC management to be performed under international standards.

2020. Domestic SME integration to increase international competitiveness. Participants of the foresight session emphasized that there is serious need to elaborate number of networking formats, which would allow Vietnam SMEs to merge their forces to face challenges of the global markets.

e. Growing competition

Growing competition is a consequence of the growing demand on the one hand and global integration on the other. In the past years number of mechanical enterprises in Viet Nam, increased more than 20 percent every year. Nevertheless, it seems that at the moment main part of Vietnam companies of the sector lack of international competition and are not ready to enter the global markets.

Hard and soft technologies appearing on the trend (as forecasted by the foresight session participants):

2016. Design and brand protection as a key part of business operation. Participants of the foresight session agreed that they need in the nearest 1-2 year establish the culture of brand and design protection.

2017. Improved intellectual property regulation. As in most developing countries, Vietnam has immature intellectual property legislation and this influences the competition a lot leading to lots of counterfeit goods.

2020. Association of the ‘fair play’ companies. Participants of the foresight session offered to establish a kind of fair-play association which would unite producers following Code of Honor in terms of competition, rights protection, etc. Members of such association could use some sign of quality, similar to Les Clefs d'Or, which will demonstrate the quality of their products to customers.

f. Growing environmental requirements

In the current agenda there is growing concern regarding environmental issues. Mostly this concern refers to economically developed countries, but in developing countries companies slowly began to recognize the importance of the protection of the environment. This concern influences the

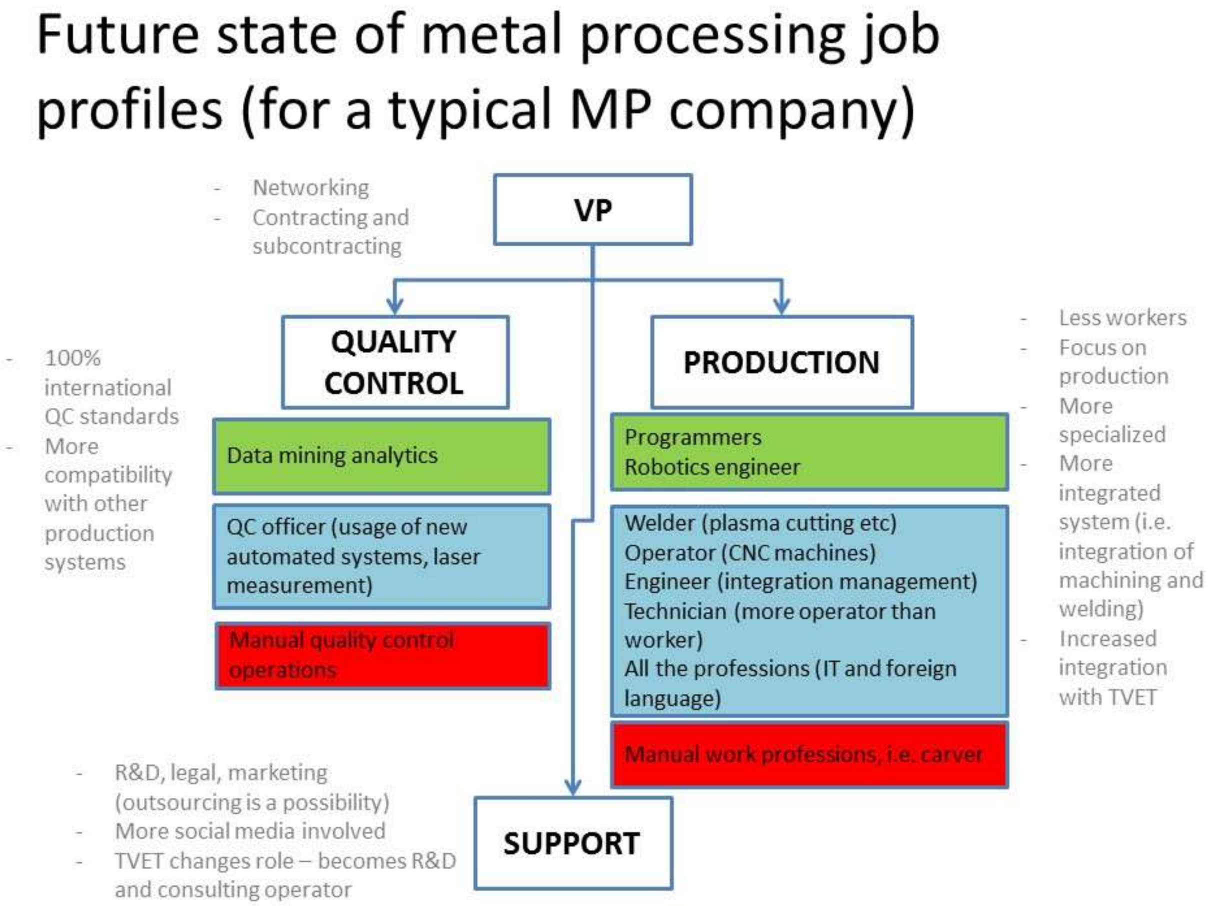
2015. TVET education programmes in environmental protection. According to participants' opinion not only subjects such as ICT or foreign language or entrepreneurship but also the environmental protection programmes should be included in TVET curricula.

2018. Green Energy in manufacturing. Growing requirements regarding environmental protection mean that soon the industry will face the need to increase its awareness about the ecological ways of energy production.

2019. Environmentally friendly composites (and new methods of processing). Composites of various types are becoming very popular now and the companies willing to gain substantial market share will focus on the composites which are not only cheap or light but also leave lighter trace.

2.2 Metal Processing Support Industries Sector in Viet Nam-2025. Typical job profiles

Talking about the future of the industry, participants of the foresight session formulated the following vision of the typical metal processing company scheme and key job profiles by the year 2025.



According to the groups' opinion overall structure of the metal processing company will change.

In **production** number of new tasks or even dedicated positions (e.g. programming and robotics engineering) will become essential. Number of existing positions will change scope of application:

- Welder will need to know new technologies such as plasma cutting etc.
- Operator will need to be familiar with CNC machines
- Engineers will be required to use integration management
- Technicians will become more operators than workers
- All the professions will need ICT and foreign language knowledge

Due to automation and robotization, there will be less workers, who will be more specialized and will use more integrated systems. The whole system will be more integrated with TVET.

Manual work professions will mainly become obsolete.

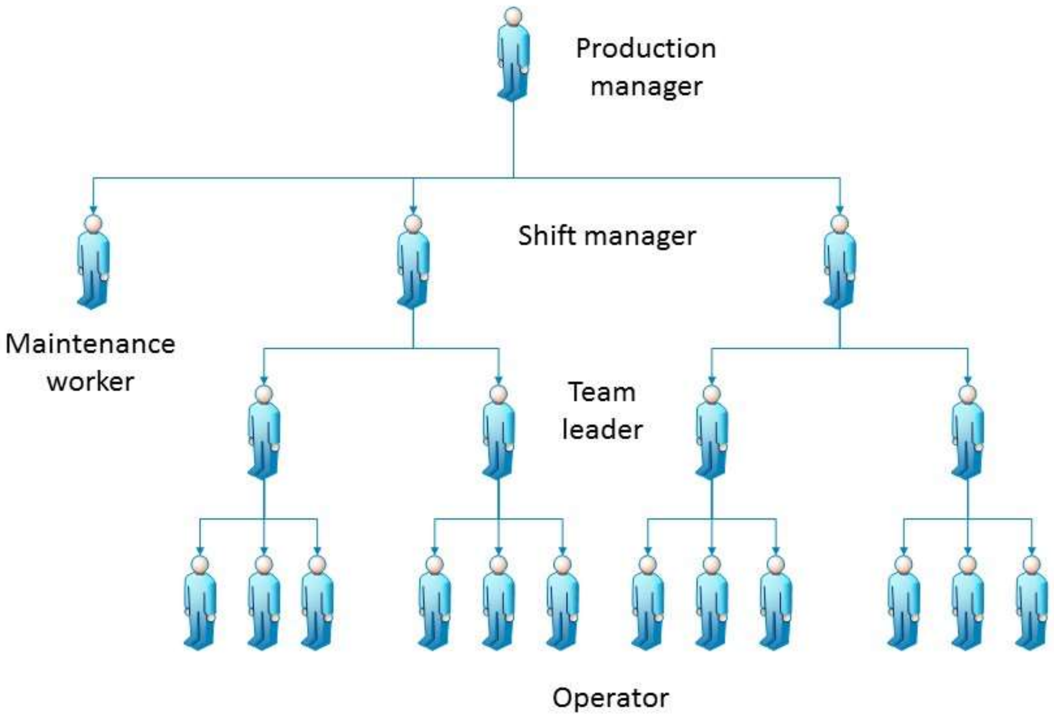
In **quality control** one of the new task will become data mining analytics. Regarding existing job profiles with changing scope of application, quality control officers should be able to use hi-tech automated systems, laser measurement and so on. All Vietnam companies will use international quality control standards. Manual quality control operations will become obsolete.

Significant changes will affect **support** department of generic metal processing company: R&D, legal and marketing activities could be outsourced, more social media will be involved in such processes. An important finding was the idea of possible TVET’s role change: it can become R&D and consulting operator.

3. Key Profile & Skills

3.1 Production

Production unit of the typical metal processing company can look as following:



- Operator
  - Skills: machine operating, programming of CNC machines, measurement techniques [incl. new methods such as laser measurement], soft skills (teamwork, communication etc.)
  - Knowledge: work safety, hygiene, tolerance, technical drawing, measurement principles, principles of mechanics, metal processing & welding methods, Kaizen and other process improvement methodologies
- Team leader (in addition to operator)
  - Knowledge: production planning
  - Skills: IT skills, foreign language
- Shift manager (in addition to team leader)
  - Knowledge: process control, machining technology
- Production manager (in addition to shift manager)

- Knowledge: statistics, data analysis, HR management, quality management
- Skill: teamwork, presentation, communication

- Maintenance worker (in addition to operator)
  - Skills: repair and maintenance of machines and equipment
  - Knowledge: mechanics, electronics, tech drawing, laser technology

3.2 Quality control

Quality control officer's tasks and skills:

- Input materials quality control:
  - Structure and composition of materials
  - Knowledge of Vietnamese and international standards
  - Tool checking
  - Reading and understanding of technical drawings
  - Technical specifications
  - Use of measurement tools and equipment
- Products after processing quality control:
  - Reading and understanding of technical drawings and technical specifications
  - Use of measurement tools and equipment
  - Statistics
  - Quality control systems
  - Soft skills: translation of working instructions, presentation, planning, teamwork
- Final product quality control:
  - Product's ID understanding
  - Regulations on delivery
  - Storage rules
  - Good manufacturing policies

3.3 Support

- Marketing officer
  - Soft skills (communication, presentation, teamwork etc.)
  - Knowledge of B2B marketing methods

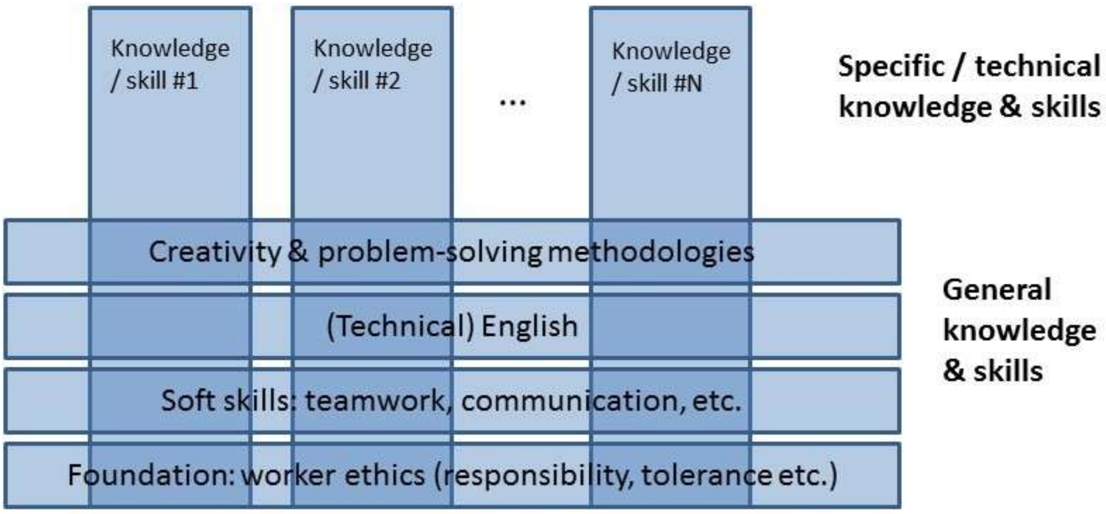
– Market knowledge
– Technical knowledge (product specifications, standards)

- Legal counsel
  – Soft skills (communication, presentation, teamwork etc.)
  – Domestic and international laws
- Designer
  – Creativity
  – Technical knowledge (drawing, 3D modelling etc.)
  – Understanding of mechanical engineering principles (materials etc.)
- Customer service officer
  – Soft skills (esp. communication)
  – Procurement practices understanding
- Process improvement specialist
  – Metodologies of process improvement (Kaizen etc.)
  – Technical knowledge (equipment productivity, logistics etc.)
  – Creativity
  – Knowledge integration

4. Proposals for the Vietnam training system changes

Summarizing the results of the skills technology foresight session participants offered number of proposals for changing in the workers training process.

Future training model should work by combination and integration of general knowledge and skills (e.g. soft skills, English, problem solving etc.) into all components of technical training.



4.1 New operator training

#	Training component changes	Responsible	Outcome
1	Professional ethics and working style training as a basis	TVET/Businesses	More disciplined workers
2	Soft skills training (focus on teamwork and communication)	TVET	Communication improvement
3	Technical English and IT training	TVET	Information research skill. Ability to study on their own
4	Increase time for technical drawing training	TVET	Ability to apply standards and reduce errors
5	Increase time for practical training on measurement	TVET	Accuracy of working operations increased
6	Practical training – partnership with businesses (focus on integrated production)	TVET	Practical based education
7	Reduce theoretical & increase practical training	TVET/Businesses	More experience before start of work

4.2 Quality control after processing training

#	Training component changes	Responsible	Outcome
1	Reading and understanding technical drawings. Include skills allowing reading and understanding technical drawings	TVET/Businesses	Students can read and understand tech drawings
2	Using high-end equipment and tools (lasers, 3d technologies)	TVET/Businesses	Students can classify and use properly these tools
3	Measurement skills	TVET/Businesses	Students get familiar with measurement skills
4	Statistics & reporting, data analysis	TVET	Students can exclude additional information from reports and data gathered
5	International quality control standards	TVET	Students can apply international standards to work of the company
6	Planning skills	TVET	Students can make and execute quality control plans
7	Good understanding of the materials, not only size, but the composition of materials	TVET/Businesses	Students know all the materials used and their features critical for technology. Businesses can help TVET to access new equipment and materials
8	Equipment and machines (requirements, shapes, size, etc.)	TVET/Businesses	Students get familiar with modern machines. Businesses can help TVET to access new

			equipment
9	International product identifications understanding (ID showing material, etc.)	TVET	Students can read and understand international identifications
10	Mistakes and risks analysis and proactive actions to 'fix the system'	TVET	Students can find and remove risks in their activity
11	Teamwork	TVET	Students can organize their work in groups

4.3 Metal processing worker with design competencies

Currently the Vietnamese metal processing industry faces the problem of shortage of specialists with design competencies. Therefore the plan is aimed at getting by 2020 approximately 4 thousand workers in this sector able to design new products.

#	Action	Responsible	Outcome
1	Develop the curriculum and educational modules (creativity and 3D-modelling)	TVET/Businesses	New modules created
2	Train lecturers. Recruit new or retrain current ones	TVET/HR departments	Trainers ready to teach students
3	Creating infrastructure and facilities for the education modules	TVET	Ready to use infrastructure for future designers training

4.4 Introduction of technical process improvement / re-engineering into TVET system

Role of TVET should shift from educational facility only to provider of educational, R&D and consulting services for process optimization, re-engineering, etc.

Typical joint Business / TVET project of process improvement described below

#	Activities	Responsible	Outcome
1	Survey to understand the process	Business (with participation of TVET)	Identify process components needed to be changed
2	Discuss the new process, new machines. Make a plan to implement new ideas	TVET + Business	Ready to implement plan
3	Piloting and then scaling up of the project	TVET (pre-piloting); Business	Improved and/or optimized process

5. Conclusion. Key Findings

Summarizing all the above, below are the key findings of the skills technology foresight session in Vietnam:

1. Global integration and specialization will define major changes in job profiles in metal processing industry
2. Digitalization and green manufacturing will be main drivers of technology changes in the industry in next decade
3. Soft skills training should become an integral part of all TVET education. Importance of soft skills (teamwork, communication, creative thinking, presentation) increases – especially teamwork (workers now are trained as individuals, not as teams!), and this will require not only new educational formats, but new student assessment methods as well
4. Process improvement methods should become a standard component of worker training
5. TVET and business companies should build new type of partnership based on proactive skills development and mutual operational process knowledge enrichment – this will require improved framework for collaboration
6. Role of TVET in the future should shift from education and training only to a combination of educational and consulting services (primarily in process improvement)

Businesses also expressed a great concern about the deficit of young workers on the labour market (decreasing popularity of blue collar jobs, peer pressure on students not to go to TVET). Best international practices that help increase popularity of blue collar jobs could be applied: career ladder tools, career navigation (e.g. Jobs of the Future), national skills competitions (e.g. based on World Skills), etc.

Businesses and TVET system should also cooperate more closely.

1. TVET (in partnership with business) should become provider of creative environment with creative competitions, real-life case solving etc.
2. Business now participates in TVET via scholarship, but business needs this practice to be more transparent. Better framework for TVET-business collaboration is required
3. Dialogue between TVET and business on future skills needs is important and valuable. It should be continued on more systematic basis (i.e. regular meetings, 1-3-5 yrs planning, implementation roadmap etc.)