THE MANUFACTURER
SELF-ASSESSMENT

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GND tool

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Executive summary

With fundamental shifts in the advanced manufacturing landscape, companies are working hard in developing innovative business models to keep up with changing demands and ongoing disruption. Digitisation is forcing manufacturers to reinvent their operations and supply chains to fully realise the benefits of a connected ecosystem, attract talent and improve their operational efficiency.

However, many manufacturing companies struggle to embrace advanced manufacturing technologies and systems. A recent study[1] shows that for nearly three-quarters of the firms, the most important barrier to the uptake of advanced manufacturing technologies and systems is the high cost of investments in advanced manufacturing acquisition and the lack of financial resources. Apart from that, firms experience a lack of skilled personnel required to adopt relevant technologies and business models. Industry experts summarise the main challenges as follows: difficulties in attracting & developing talent with the right qualification & level of expert knowledge; difficulties in connecting employees with technology; too much pressure on day-to-day business environment; employees unwilling to change towards a more automated and digital way of working; slow and not an efficient product development (from concept to realization); inability to provide real-time information on the shopfloor; an unclear strategy to generate added value from (machine) data; difficulties in discovering and executing servitisation opportunities; difficulties in realising new eco-systems with supply chain partners; difficulties in creating value through sustainability & resource efficiency.

The European Advanced Manufacturing Support Centre financed by the European Commission defined 7 transformation areas for manufacturing companies. These areas are defined as Advanced Manufacturing Technologies; Digital Factory; ECO Factory; End-to-End Customer Focussed Engineering; Human-Centred Organization; Smart Manufacturing, and Value-Chain Oriented Open Factory. Based on these transformation areas below in this Manufacturer Self-Assessment are provided questions to be answered by representatives of respective manufacturing enterprises. After completion of this self-assessment, the GND experts will provide a throughout analysis, in-depth advice and assistance in the preparation of transformation plans, and needed support for obtaining financing for the implementation of advanced technologies and systems.

Personal Data Protection

This Manufacturer Self-Assessment is prepared by European Advanced Manufacturing Centre methodology which is provided on behalf of the European Commission's Executive Agency for Small and Medium-sized Enterprises (EASME). Your privacy, personal and company data protection will be guaranteed in conformity with the European Regulation (EU)2018/1725. Your data will be processed in a separate database from the results of the survey in order to guarantee the anonymity of the survey and will not link your data with other databases. By filing this assessment and providing it to GND you agree with personal and company data protection policy. For more information regarding the processing of your data, you can read the privacy policy https://ec.europa.eu/info/privacy-policy_en or contact us via info@gndpartners.com.

[1] An analysis of drivers, barriers and readiness factors of EU companies for adopting advanced manufacturing products and technologies: http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item id=9061

Transformation 1 – Advanced Manufacturing Technologies

This transformation is based on deploying state-of-the-art manufacturing devices. Given the high wage level, European manufacturing companies cannot afford to manufacture using machinery that is outdated and hampers productivity. Factories of the Future develop their own devices for key components in production, and thus boast machinery that is globally unique.

Vision

Within a Factory of the Future there is a clear vision on how technology is to be used for gaining competitive advantage. The vision is translated into a roadmap of strategic plan.

1. **Strategy:** A clear investment policy that matches the strategic vision is put into practice.

- ☐ Out-of-date machines are replaced ad hoc.
- ☐ An investment plan for replacing out-of-date machines exists.
- ☐ A detailed multiyear investment plan exists for the introduction of state-of-the-art technologies.
- ☐ The company's technology roadmap includes multiyear investment plans as well as the evaluation of new technologies through feasibility studies.
- ☐ The company's technology roadmap includes a research and development approach for advancement of relevant technologies to higher maturity levels.

2. **Awareness:** Technology is evolving rapidly making it necessary to gather information and build up knowledge in order to support investment decisions.

- ☐ Input from suppliers is acquired in a passive way.
- ☐ Current company technology information is actively acquired through suppliers and technology & trade fair visits.
- ☐ Information on a broader range of technologies is actively acquired through suppliers as well as technology & trade fair visits.
- ☐ Advancements in state-of-the-art production technologies in general are actively tracked by attending technology fairs and conferences, as well as by talking to suppliers, researchers, academics, etc.
- ☐ The company is actively involved in sectorial technology roadmap development.

Level of Capabilities

A Factory of the Future has the capability to introduce and operationalise advanced manufacturing technologies.

3. **Technology:** State-of-the-art manufacturing technologies are being used.

- ☐ The company acts at a similar level as the competitors in same sector.
- ☐ Some state-of-the-art technologies are present.
- ☐ All key technologies are state of the art and in accordance with the newest commercially available standards.
- ☐ Technology has been adapted to gain a considerable competitive advantage.
- ☐ New technologies are developed from Proof of Concept to Production Ready in order to maintain and even gain a global competitive advantage.

4. **Integration:** Advanced manufacturing technologies are implemented easily.

- [ ] Ready-made solutions are obtained from the technology supplier who is in the lead from design to implementation.
- [ ] Ready-made solutions based on a specific design are obtained from the technology provider.
- [ ] Technology is implemented making full use of its current capabilities.
- [ ] Technology is adapted to meet specific future-oriented production demands, like quality, speed, etc.
- [ ] Technology is adapted such that it smoothly integrates into the complete production process.

5. **Quality:** Advanced manufacturing technologies are used to meet and even set quality standards.

- [ ] Quality is at a similar level and extent as the competitors in same sector.
- [ ] A competitive advantage is gained by excelling in several quality features.
- [ ] Technological limits are explored to achieve higher end product quality.
- [ ] High end product quality is achieved by pushing the technological limitations.
- [ ] The company sets the standards and is being considered a reference in end product quality.

6. **Employees:** Employees are qualified to handle advanced manufacturing technologies.

- [ ] Trainings are being organised by technology suppliers for new individual employees.
- [ ] The company organises annually update trainings for machine operators.
- [ ] In order to optimize technology usage, the company organises trainings for all individual employees at regular intervals.
- [ ] The company supports individual employees in achieving expertise levels to enable them to implement process improvements themselves.
- [ ] Individual employees achieve expertise levels enabling them to fully cope with new technologies.

Level of Implementation

Advanced manufacturing technologies are managed in a professional way.

7. **Maintenance:** The maintenance strategy enables high levels of Overall Equipment Effectiveness (OEE).

- [ ] Reactive maintenance is being effectuated.
- [ ] A preventive maintenance plan follows fixed time schedules.
- [ ] Maintenance is managed based on current technology usage, e.g., interventions at pre-determined equipment usage levels.
- [ ] Predictive maintenance is being executed through productivity measurement at pre-determined equipment usage levels making sure interventions are only done if needed.
- [ ] An intelligent maintenance plan is based on real-time monitoring of critical components, enabling focussed interventions at the moment of potential productivity loss.

8. **Tools:** Short lead times are the key driver for handling manufacturing equipment by using the right fixtures, jigs and other tooling.

- [ ] All necessary manufacturing equipment tools are easily available.
- [ ] All necessary manufacturing equipment tools are marked, categorized, etc.
- [ ] All manufacturing equipment tools are registered in a central system in order to enable equipment usage tracking.
- [ ] In order to enable equipment location and usage tracking, manufacturing equipment tools are monitored and tracked by production order.
- [ ] Key manufacturing equipment tool parameters are continuously monitored in order to track real time how equipment is being used.

Stakeholder Focussed

Manufacturing with stakeholders in mind.

9. **Manufacturing area:** Desk-based office space, production and assembly areas embody the image of a Factory of the Future.

- ☐ The shop floor is clean.
- ☐ The shop floor is clean and machines are positioned in an orderly, logical way.
- ☐ The shop floor is clean, machines are positioned in an orderly, logical way, stock material and Work in Process products are neatly placed at dedicated locations.
- ☐ The shop floor is used as a marketing tool towards clients.
- ☐ The shop floor is used as a marketing tool towards clients, management, Board of Directors, general public, etc.

10. **Health & safety:** Health and safety is a top priority.

- ☐ All machine safety requirements are met and individual employees are provided with appropriate safety equipment like glasses, gloves, safety shoes, etc.
- ☐ All machine safety requirements are met and visitors are provided with appropriate safety instructions as well as the necessary equipment like glasses, shoes, etc. Between machines sufficient space is available.
- ☐ The company's health & safety representative actively works on improving health & safety. Between machines sufficient space is available.
- ☐ All employees within the company are actively working on improving health & safety.
- ☐ The company actively invests in acquiring expertise on handling health & safety for newly developed technologies.

11. Did you already realize projects or deliverables in context of this transformation area?

T1 - Additional Questions

- Which innovations/investments have you made on the shop floor in recent years?

- What exactly is your multi-year plan for the introduction of new technologies?

- How do you bring information about a wider range of technologies into the company?

- To what extent and according to which methods do you use all the possibilities of implemented technological solutions?

- How do you organize the maintenance management?

- How are the machines, all stock material and partially finished/ready material positioned on your production floor? Which system/logic is behind this?

Transformation 2 – Digital Factory

Companies use digital technology to transform the development of products and/or processes into physical products, systems or services. All employees are supported by digital and integrated processes. Integral control of the digital information flow ensures the simulation of virtual scenarios before actually implementing the activities. The digital factory guarantees the accuracy of the data at any given moment in time. Each data item is only entered once into the system and all other systems retrieve the data item automatically to create new information, a so-called Single Source of Truth.

Enabling Infrastructure

The company has a flexible and secure ICT infrastructure, enabling the digital transformation.

12. **Connected shop floor:** Shop floor entities are connected to enable data exchange.

- ☐ Machines and other shop floor entities mainly act as stand-alone systems and are not connected to a network. Data (if any) is transferred using intermediate hardware, like a memory stick, flash card memory, etc.
- ☐ Some equipment is connected to a company network. Data is transferred manually to or from the equipment (e.g., programs can be transferred to the machine over the network, but the transfer itself is most often initiated manually).
- ☐ Equipment is connected to a company network providing access to the most important information and enabling the transfer of information to and from the machine. Important legacy equipment is digitally enabled through a connectivity module and/or digital identification tags.
- ☐ All vital equipment is connected and intelligence is added through the integration of sensors, gateways, etc. The exchange of data between machines and other shop floor entities is carried out via the network through middleware and/or MES systems.
- ☐ All shop floor entities are smart and connected in an open way and autonomously share information. Data communication is carried out via standardised and open data structures. Any entity can connect to any other entity if desired or required.

13. **A digitally supported production network:** The supply chain is digitally connected.

- [ ] The supply chain is not digitally connected. If information like customer specifications for quotes, production status, delivery information, etc is transferred between parties manual or paper-based interventions are needed to obtain the required information.
- [ ] Parts of the supply chain are digitally connected. A product service system is in place. Upon request, digital information is or can be provided. This information comes from a central system (information is stored), but extracting the information still requires manual interventions.
- [ ] Most parts of the supply chain are digitally connected. Third parties are automatically informed about basic relevant events, like delivery dates, delays, etc.
- [ ] A predominant portion of supply chain interactions are digitally supported and automated. Most supplier and customer information are received digitally and automatically processed with limited human intervention. A digital product configurator is available and human interventions are only needed for e.g., fixing delivery times.
- [ ] The supply chain is fully digitally supported and dynamic interaction from order to delivery is in place. Online product configurators, calculation & simulation models, real time info sharing platforms and/or online auctions support the customer in a fully digital and automated way. User interaction and feedback are integrated automatically. Customers can obtain real-time information on the status of their orders.

14. **Secure digital infrastructure:** Security information and event management systems safeguard a continuous & smooth manufacturing operation.

- [ ] The organisation manages individual security updates of some devices, but is unaware of the overall (cyber) security status of every device, access point, etc. The organisation has not yet put in place measures to protect the digital and physical security of its infrastructure and production system and is therefore vulnerable to attacks.
- [ ] The organisation complies with existing industry and security standards Responsibility lies mainly within the ICT department and reviews of policies, procedures and third-party risk assessments happen occasionally. As the organisation is unprepared, breaches go largely unnoticed.
- [ ] The organisation is aware that data are to be considered an important asset that has to be protected and for which trusted data exchange systems need to be ensured. The organisation defends itself by deploying cybersecurity technology, such as gateways, firewalls, DMZ setups, ACM and/or anti-malware protection. The ICT department is still responsible, but periodically also third-party risk assessments are executed.
- [ ] The organisation has put in place a comprehensive Security Information and Event Management system, seeking to avoid attacks. Management understands the importance of cybersecurity and the need for a dedicated policy with regular reviews. The ICT department focuses on the critical day-to-day operation of the network, and third parties are approached to take over some of the security responsibilities when appropriate.
- [ ] The organisation has a system to detect anomalies and breaches, as well as a threat intelligence system, feeding back information to other operative elements in place. Management is largely involved. Reviews and risk assessments are ongoing, with third-party expertise alleviating the security workload of the ICT team where needed.

Digital Capabilities

Aside from having digital capabilities to optimise production with process data, the company also translated a clear vision on digitisation into a roadmap or strategic plan.

15. **Transparent view on shop floor status:** Real-time production data are used for optimisation and decision making.

- [ ] There is no transparent view on the actual shop floor status. Specific (manual) effort must be taken to find out what is happening. Procedures and digital data are hardly in place to facilitate this process.
- [ ] The most important processes are monitored on paper and/or digitally and the data is stored on a periodic basis. People are able to find out what is happening in production but accessing and assembling this information delay appropriate actions and countermeasures to a large extent. The company's ICT systems are not always coupled, requiring manual combination of data from different sources.
- [ ] Up-to-date information is available and visualised through production dashboard. Employees are involved in a timely fashion if e.g., a machine breaks down in production.
- [ ] Production data is used for ad-hoc analytics to support decisions. Some analytics might be integrated in decision support systems for e.g., predictive maintenance. Remote monitoring of equipment is implemented enabling machines to automatically notify personnel when there is an issue. The company has executed first experiments around data analytics and automated decision making through Machine Learning and Artificial Intelligence is being implemented.
- [ ] Data analytics are integrated within decision support systems and automated decision making through Machine Learning and Artificial Intelligence is being implemented.

16. **Digital operator support:** Digital tools are used to support the operators in their tasks.

- [ ] Operators mainly use paper-based instructions or single digital terminals (islands) at workstations to get information on the tasks they have to execute and the orders they have to process.
- [ ] Basic static information like CAD files, are digitally available for the operators upon request. Specific manual effort is needed to ensure that the provided information remains up-to-date.
- [ ] At the different workstations digital work instructions are available. An assigned employee ensures that the information available is up to date, using information form central systems like ERP, CAD, PDM, etc. as much as possible.
- [ ] Operators have access to digital, personalized work instructions and relevant information to execute their tasks. This information comes from central systems and all information is centrally and automatically stored, managed and maintained.
- [ ] Operators have access to all necessary information and can interact in a dynamic way, by e.g., providing feedback, proposing changes, etc. directly on the digital platform and connected to the central database. Emerging tools/technologies are used to provide this information in the best possible way through devices like smart glasses, wearables, tablets, AR/VR devices and/or projection systems.

17. **Application and data integration:** ICT applications are integrated.

- [ ] Different ICT applications are used but they are not coupled. Data from different databases is combined manually.
- [ ] Some ICT applications are connected through the ad-hoc integration of databases. Application Programming Interfaces (API's) are used occasionally.
- [ ] Most ICT applications are integrated following a standardised approach. A central database is used as an engine. APIs are used frequently.
- [ ] All ICT applications are fully integrated, whether using ad-hoc integration, or, in some cases, generic and standardised interfaces at the Industry 4.0 / IoT state-of-the-art level. Adding new applications and integrating them can be done with little effort, even internally within the company.
- [ ] All ICT applications are fully integrated using state-of-the-art, standard IoT interfaces and Cloud technology. This configuration allows for optimisation of the total supply chain, linking external software and Software-as-a-Service.

18. **Mastering the digital transformation:** The digital transformation is managed and forms a part of the company's DNA.

- [ ] The digital transition happens on an ad-hoc basis and is not managed. This typically causes loose ends or uncoordinated developments like data that might be available but is not used, operators that are not properly trained for the digital enabled equipment, etc.).
- [ ] The organisation is convinced of the importance of a digital transformation. Some aspects of the digital transformation are managed. However, a digital roadmap linking all elements and guiding the transition is not yet available.
- [ ] The organisation has defined a shared vision for digitisation and is convinced of the need for a well-managed transition. Information and knowledge are being gathered in order to define a roadmap for the digital transformation.
- [ ] The organisation has a clear roadmap for the digitisation process and has defined the required expertise/capabilities, priorities, responsibilities, etc. Core teams are formed for the roll-out and progress is continuously monitored. External expertise is called upon when needed.
- [ ] The organisation has a well-managed digital transformation in place. A large part has already been digitised and a system for continuous digital knowledge acquisition is in place. The digital transformation and all its aspects are part of the company's organisational and cultural DNA.

19. Did you already realize projects or deliverables in context of this transformation area?

T2 - Additional Questions

- How is the majority of supplier and customer information received and processed?

- How do you think you can digitally activate important, outdated machines? What do you think are the possibilities of e.g., a connectivity module and/or digital identification tags?

- How do you protect yourself against external attacks?

- How do you make important (process) information visible on the work floor?

- How do you keep your work instructions up-to-date and make them visible on the work floor?

Transformation 3 – ECO Factory

Being a front-runner in eco-production offers companies advantages such as cost reduction, risk reduction in raw material and energy supply, as well as in terms of a company's social responsibility image. Sustainable production includes a resilient production system based on the availability of raw materials and auxiliary materials. These systems are capable of closing the material cycle in order to optimize the efficiency of raw material usage. The production system is aimed at a drastic reduction in energy consumption and the use of renewable energy sources. Companies are well attuned to the significance of the environmental impact of their activities and are constantly searching for ways to reduce the ecological footprint of their processes, products and services.

Resource Management

The company systematically reduces its dependency on non-renewable energy sources, raw and auxiliary materials as well as water.

20. **Materials usage:** The company reduces material consumption through product and manufacturing optimisation.

- [ ] Several incremental material consumption improvement actions have been implemented
- [ ] Project-driven material usage improvements of the most relevant products and manufacturing processes have been implemented.
- [ ] The company has set specific objectives and implements a methodological approach covering the transformation of materials consumption at machine, process and factory level.
- [ ] The company draws upon the best available technologies to reduce the material usage of machines, processes, products and methods.
- [ ] Systems capable of closing the material cycle in order to optimize the efficiency of raw material usage (also called Circular Economy principles) have been implemented through strategic and stable partnerships with customers, suppliers and other key experts.

21. **Energy consumption:** The company reduces energy, fuel and water consumption of its products and manufacturing processes.

- [ ] Several incremental energy consumption improvement actions have been implemented.
- [ ] Project-driven energy usage improvements of the most relevant products and manufacturing processes have been implemented.
- [ ] The company has set specific energy consumption objectives and implements a methodological approach covering the transformation of energy usage at machine, process and factory level.
- [ ] The company draws upon the best available technologies to reduce the energy usage of machines, processes, products and methods.
- [ ] The factory invests in strategic and stable partnerships with key experts in leading methodologies and technologies in the area of energy consumption.

22. **Waste flows management:** The company reduces waste flows and emissions of its products and processes, thereby recovering a maximum of materials and energy.

- [ ] Several incremental waste flow improvement actions have been implemented.
- [ ] Project-driven waste flow improvements of the most relevant products and manufacturing processes have been implemented.
- [ ] The company has set specific objectives and implements a methodological approach covering the waste flows at machine, process and factory level.
- [ ] The company implements the best available technology to reduce waste flows in product development, manufacturing and in terms of infrastructure.
- [ ] The factory invests in the establishment of strategic and stable partnerships with key experts in leading waste flow reduction methodologies and technologies.

Compliance & Innovation

A resilient and robust organisation successfully withstands the impact of climate change and resource depletion.

23. **Rules, regulation & standards:** The company actively deals with both existing as well as new rules, regulations and standards.

- [ ] Products and internal processes comply with existing rules and regulations.
- [ ] The company as well as its supply chain is compliant with existing rules and regulations.
- [ ] The company applies effective and timely methods for integrating new regulations into products, processes and the supply chain.
- [ ] The company applies a proactive approach towards the application of new as well as emerging rules, regulations and standards leading to a competitive advantage over its direct competitors.
- [ ] Within its value chain, the company is considered a reference stakeholder in the process of shaping new rules, regulations and standards.

24. **KPI's and targets:** The company structurally addresses environmental impact measurements.

- [ ] Aside from obligatory targets related to compliance with rules and regulations, no other KPIs are set to address the environmental impact of the company.
- [ ] Basic measurement, benchmarking and communication around environmental impact improvements over the product's entire life cycle exists.
- [ ] The company implements a structural control, benchmark and management system with indicators that go beyond existing rules and regulations.
- [ ] An integrated approach is defined and implemented in order to achieve continuous improvement of internationally benchmarked customer and society targets related to environmental impact.
- [ ] The actual measurement of the ecological footprint aims at a reduction of the environmental impact over the entire value chain, explicitly taking customer and societal expectations into account. KPIs and targets adopted by the company are considered to serve as a reference for international industry standards within the value chain.

25. **Business process:** The company uses specific business process and management systems to minimise the environmental impact.

- [ ] Business processes to address specific environmental issues are not defined.
- [ ] Specific actions to address basic environmental issues are activated within the business processes.
- [ ] A methodological approach is adopted to include actions targeted towards the minimisation of environmental impact within business processes, e.g., through the use of Business Balanced Scorecards.
- [ ] The company adopts a customer oriented integrated risk management approach connected to environmental topics.
- [ ] The company implements new eco-production business models in order to close the material loop and reduce the environmental footprint, thereby taking customer and society expectations explicitly into account.

26. **Innovative approach:** The company engages its network and stakeholders towards reducing the environmental impact. Innovative ecological techniques and methods are used in product design, industrial processes and/or logistics.

- [ ] The company carries out non-methodological activities targeted towards sustainable production independently of other stakeholders.
- [ ] Some key stakeholders have been selected for carrying out specific one-off projects in order to reduce the company's environmental impact.
- [ ] The environmental impact of products over their entire life cycle is structurally integrated into product, process and/or service development, where all important value chain stakeholders have been identified and benchmark evaluations are carried out to assess the status with respect to other companies.
- [ ] The stakeholders are identified and an integrated environmental approach has been widely deployed, where multilateral contacts lead to significant breakthrough innovations in the product, production and/or service creation process impacting a large part of the company's value chain.
- [ ] The company is not only looking at the minimisation of the environmental impact through a systemic innovation approach in all phases of the product, process and/or service development, but it is also a leader in the creation of a local ecosystem involving a network of actors across the entire value chain and across sectors.

27. Did you already realize projects or deliverables in context of this transformation area?

T3 - Additional Questions

- How do you deal with material consumption at machine, process and factory level?

- How do you tackle energy consumption at machine, process and plant level?

- How do you deal with the waste flows at machine, process and factory level?

- How do you measure the environmental impact of your manufacturing processes?

Transformation 4 – End-to-End Customer Focussed Engineering

Manufacturing companies use customer expectations as the key driver and starting point for all new developments and processes. Robust, high-quality product, manufacturing and service creation processes are the result of a cross-functional and cross-departmental design approach. Supported by the use of virtual models and simulation tools where possible, this transformation optimises processes to create maximum value throughout the design, manufacturing, usage, servicing and disposal part of the company's value chain.

Customer Focus & Value Proposition

The company maximises customer value creation whilst carefully managing related costs and risks.

28. **Customer integration:** Market and customer information is systematically gathered, incorporated and documented during the product, process and service development.

- ☐ Input from sales is being used by engineering.
- ☐ Key account requirements are actively incorporated in the engineering of the products.
- ☐ Requirements of as many customers as possible are actively incorporated into the engineering and manufacturing of the products.
- ☐ Customer requirements are systematically documented and integrated throughout the engineering, manufacturing and servicing steps of the products.
- ☐ All customer requirements are continuously kept up-to-date to be used throughout all engineering, manufacturing and servicing processes in order to obtain the highest possible value solution for each individual customer.

29. **Customisation:** In order for the company to meet as many specific customers' needs as possible, the company develops, implements and documents a 'standardized building block' approach – also called 'modular approach'. The aim is to offer the customer a multitude of product options whilst at the same time keeping the manufacturing complexity of these products inside the company as low as possible. This way of working is also known as a 'Design for Manufacturing' approach.

- ☐ Product families vary mainly in physical dimensions and few geometrical aspects are available.
- ☐ Modular designed products are configurable but configuration options are only available to engineering.
- ☐ The customers can configure their own product by selecting options/modules.
- ☐ Design for Manufacturing methods enable the economical production and offering of customized products.
- ☐ All customer requirements are continuously kept up-to-date to be used throughout all engineering, manufacturing and servicing processes in order to obtain the highest possible value solution for each individual customer.

30. **Servitisation:** The company's value proposition does not purely focus on the product itself but also includes solution providing services, (e.g., if a machine builder can receive and analyse usage data from a specific machine at the customer's premises, the exact moments and needs for maintenance of that machine can be better predicted).

- [ ] Generic after-sales services are being offered.
- [ ] Product features are engineered with specific value adding services in mind.
- [ ] Results oriented product services are used and internally support engineering activities.
- [ ] Results oriented product services clearly address individual customers' desired outputs and functionality goals.
- [ ] Services surpassing the product level are being developed and are offered. Instead of asking customers which product they'd like to be offered to them, the company focuses on which specific customer problems they could solve in a new, innovative manner.

Robust Engineering Processes

In order to speed up time to market, the company uses design, manufacturing and disposal processes that are robust, standardized and of highest quality.

31. **Interdepartmental co-creation & stakeholder involvement:** In order to simultaneously develop products and related manufacturing processes, all internal and external stakeholders work together from start to end. Throughout the organisation, cross functional teams are formed to develop faster and better towards a common goal while avoiding sub-optimization.

- [ ] A selection of the individual engineering employees master project-focused work methods. Improvements in processes are initiated by managers or specialists. The organisation works ad hoc on process improvement.
- [ ] Internal stakeholders from different departments work together when moving from the development to the production phase of a product. Departments work together easily to work on improvements and redesign processes.
- [ ] New product, process and/or service developments incorporate actual production capabilities/restrictions. Individuals and managers active in operations are involved in co-creation. Individuals can work-out and participate in initiatives on new products and production processes.
- [ ] Cross departmental project teams actively work together using digital tools that can manage multiple workflows and different data sets. Individuals can easily reach out to others within the company. It is obvious for all employees to involve others to think and/or work out of the box.
- [ ] Centralized, cloud-based CAD, CAE and PLM capabilities enable the integration of multiple internal competence teams as well as external stakeholder collaboration. New and temporary project teams develop quickly to implement innovations. Individuals can easily link to other partners in the supply chain.

32. **Standards, tools & approaches:** Product, process and service engineering standards are applied and digitally supported in order to ensure reliability and predictability.

- [ ] General engineering standards and best practices guide the development process.
- [ ] Objectives and criteria are specified at the beginning of an engineering project.
- [ ] Cross departmental feedback loops are put in place to verify design and engineering choices.
- [ ] The organisation defines, refines and applies experience-based learning as well as externally acquired knowledge in order to make sure its product and process design rules will meet both customer and manufacturing needs.
- [ ] The end-to-end engineering process is supported by well embedded optimized Design to Value rules.

33. **Managing quality & robustness:** Prevention and correction actions, product and service changes, transfer processes and manufacturing feasibility tests are all documented and feed into KPI's for new products, processes and services.

- [ ] Engineering projects are documented mainly to cover scope and manufacturing feasibility.
- [ ] Engineering projects are regularly being followed up and design, production & service specifications are documented.
- [ ] The reliability and predictability of both the development of new basic technology as well as incremental product & process development is continuously maximised.
- [ ] Specific KPIs for new products, processes and services are defined, actively used and documented.
- [ ] Both internal and external feedback is converted to KPI's covering all products and processes, both new and existing.

34. **Continuous improvement:** Continuous improvement principles have expanded upstream from manufacturing towards engineering. Every employee is receptive to new technology and is engaged in continuous improvement.

- [ ] Improvement ideas are collected at the end of every project.
- [ ] Multi-disciplinary teams actively evaluate running projects in the search for improvements.
- [ ] Lean methodologies, rapid prototyping and/or other modelling techniques shorten new product, technology, process and/or service engineering feedback loops.
- [ ] The reliability and predictability of product, process and service engineering processes is a multi-disciplinary responsibility. Customers and suppliers are involved from an early planning stage as concerns new developments.
- [ ] A clear vision on the product, production and service development processes strongly increases predictability through the active management and improvement of all interfaces. Customers and suppliers see this as a strong competitive edge of the company.

35. Did you already realize projects or deliverables in context of this transformation area?

T4 - Additional Questions

- How do you integrate the requirements of as many customers as possible into the design and production of new products?

- How do you monitor the quality of your design and engineering choices?

- To what extent do cross-departmental feedback loops take place?

- What do you think about offering additional, result-oriented services connected to the products you produce?

- To what extent should these services support the internal (manufacturing) engineering activities?

Transformation 5 – Human Centred Organisation

Employee involvement in the future development of the company is crucial. Individual factory workers need to be transformed to a group of employees with the autonomy and space to channel their talent, creativity and initiatives within the context of an innovative organisation. The best fitting leadership style (servant, inspirational, coaching) should enable competence and skill development. Sustainable employability is about motivating and supporting individual employees to continue to contribute to a (any) labour process, through continuous/repetitive evaluation of their skills and update of their competencies through training, coaching, etc. The resulting climate is such that people feel the relevance of continuous learning and remain motivated to provide a top performance.

Individual Employee

The company invests in challenging jobs, thereby focusing on individual growth and self-realisation, in terms of skills, knowledge and competences.

36. **Talent & competence development:** The organization provides a systematic approach of competence and talent development through tools that are used and managed on the shop floor, such as flexi-matrices. Individual employees can work on development through diverse learning techniques and are supported in evaluating future opportunities.

- ☐ Management determines learning objectives. Training courses are not based on a training and development policy framework. Learning is focused on specific areas for which there is a shortage or obligations apply. When there is a need, it is remedied (no proactive action).
- ☐ The supervisor recognises development needs, formulates development goals and passes this input on to management. Individual employees are involved in determining educational choices. However, there is also room for ambitions as a source of inspiration for educational choices. Training courses are organised on an ad-hoc basis and are mainly administratively managed. Long- term training plans are provided for limited, specific target groups.
- ☐ Individual employees prepare development goals themselves. The organization encourages training for both immediate implementation and on the long-term, in order to develop the potential of individual employees, to seek out ambitions and to strengthen the team, in terms of multi-employability, flexibility, future-oriented skills and competences. A formally developed training program and plan is provided by the organisation to facilitate competence development.
- ☐ Teams and individual employees determine the development goals themselves and can take actions. Individual employees and teams are given the opportunity to fully develop themselves, also in domains outside the operational business context. Individual growth and self-realisation, in terms of skills, knowledge and competences are paramount.
- ☐ Individual employees not only focus on operational employability, the strengthening of team competencies and the development of talents, but also work on their own vision for sustainable employability. In an open dialogue, individual employees draw up development paths that are not directly or directly linked to the operational context of the company. The company actively supports individual employees in developing talent.

37. **Experience & knowledge accumulation:** Lessons learned are shared proactively through diverse methods, ensuring knowledge accumulation. For transfer and knowledge management, tools have been developed that enhance the (re-)use of individual experience, i.e., the operations knowledge that has been accumulated by the individual employee.

- [ ] The knowledge gained about best practices, operational problems or lessons learned is not documented, but is kept in the minds of individual employees. The management of experience (operations knowledge that has been accumulated) is seen as a managerial responsibility.
- [ ] Operational problems and solution experiences are discussed by supervisors and management. The re-use of existing experience (operations knowledge that has been accumulated) is the responsibility of those involved.
- [ ] The supervisor ensures the storage and monitoring of solution experiences. In case of operational problems, the manager reacts and provides advice. Active learning is being done.
- [ ] Although the team takes the lead in solving operational problems, each individual has the necessary knowledge and skills or knows who they can turn to for additional input. Systems for tracking lessons learned are actively used. Newly gained experience (operations knowledge that has been accumulated) is automatically distributed among all team members.
- [ ] The team autonomously manages the processes and resolves operational problems with ease, without the intervention of a supervisor or manager. They have the skills and framework to develop and improve processes, to innovate and to maintain the sustainability of all of their responsibilities. The company culture stimulates and heavily invests in learning based on acquired experience (operations knowledge that has been accumulated) and the continuous operational consultation between team members.

38. **Wellbeing and work quality: I**ndividual employees have rich and challenging jobs that are aligned with individual possibilities and talents and in an environment that provides the right amount of liberty and autonomy, to ensure that people can act outside of a context causing unmanageable stress.

- [ ] Individual employees have a job that mainly consists of repetitive work, where variation is only possible to a limited extent. Where complexity is part of the job, it is seen as challenging, but the individual control possibilities are rather limited.
- [ ] The content of the work of individual employees is varied but the repetitive work is more important than the knowledge-based work. Self- organisation and autonomy are picked up by some individual employees. The supervisors still assume a steering role to organise the interactions and interdependencies between different tasks and to ensure coordination.
- [ ] The content of work of the individual employees is varied and consists of a healthy combination of repetitive work and knowledge-based work. Self-organisation and autonomy are picked up by some individual employees, as a result of which they strengthen the functioning of the team. With more complex tasks, more control options are offered to individuals.
- [ ] Individual employees have a varied set of tasks (short-cycle and long-cycle work) that they organise themselves. Individual employees interact smoothly and without outside guidance with other team members or external parties for specific instruction, feedback, coaching or improvement proposals. Within the team all knowledge is available to perform autonomously not only the organization of the own work, but also the preparation, coordination with other teams, follow-up, reporting, etc. Individual employees can take up additional roles, but also in view of sustainable employability and an ageing workforce, can diminish the additional tasks or responsibilities they take up as desired.
- [ ] Individual employees have both varied and challenging job content with diverse and challenging work, which they can organise themselves. Team members have intense contacts with colleagues and work together smoothly to achieve team goals. Individual employees experience a lot of satisfaction in their job and in their team, due to the rich job content, the level of difficulty and the contact possibilities. The team environment offers individual employees an ample opportunity to take on additional challenges as desired.

Teams

The organisation empowers teams to ensure efficient production. Teams work with authority and responsibility.

39. **Planning and organisation of the work:** The team operates in an organisational structure where the appropriate amount of hierarchical influence is used to ensure a flexible and adequate planning, involving all contributors. Instead of involving other hierarchical levels, the organisation enables teams to take up and execute the responsibility of planning and organising the work that needs to be done.

- [ ] The ownership of planning and organisation of the work is unclear. The planning process is carried out on a top-down basis and is accompanied by a management style known as Directive Management, where the possibilities for input by lower levels are limited. There is little room for feedback from lower levels within the planning and organization of the work.
- [ ] The planning process is strongly top- down oriented. In case of conflict, the team supervisor looks for solutions, but management often has the last word. A communication structure has been provided, in which planning is discussed and feedback is possible.
- [ ] Planning and work organisation are predominantly executed top-down, in line with the objectives set by the management. Individual employees have some input, especially in terms of the implementation strategy and operational approach for their team. (Groups of) individual employees take the lead in determining how the team goals will be achieved. In case of conflicts the manager looks for solutions.
- [ ] The planning is organised by the operational team, with the expected output clearly provided as input for decisions. Teams and team members can independently prepare and adjust the planning within the limits of timely external delivery and/or other limits set by management. For example, they can shift orders themselves to do on-the- job training, thereby always safeguarding the realisation of the team KPI's.
- [ ] Operational teams determine how they organise the work and use agreed upon quality, supply chain, stock, customer orders and other criteria to do so. They autonomously determine whether they engage external resources (e.g., temporary people) and how they will achieve the requested result. They manage their own KPI's, aligned with strategy and vision. As such they make it possible to flexibly decide on which (corrective) actions to take.

40. **Objectives and KPI's:** The organization provides team specific translations of the overall company goals, giving teams targets that they can influence, follow-up on, report upon and improve via their own initiatives.

- [ ] Only the management is committed to the follow-up of strategic objectives. There is no systematic monitoring and feedback from KPI's to the first line managers. Individual employees receive no feedback about the results of their work. No visible performance indicators are present at the shop floor. Individual employees hardly have any access to KPI's.
- [ ] KPI's, in line with the business objectives, are determined by management and communicated to managers. The performance indicators that are present are monitored by the management, but not structurally communicated or used at the shop floor. The feedback on KPI's is such that it is not clearly linked to the performance of the individual employees, which makes it difficult for them to understand how they can influence the KPI's.
- [ ] The team supervisor determines the KPI's, in line with the business objectives. Individual group members know their KPI's and support them. Follow-up of the KPI's is done by the supervisor. As performance indicators are present in the work environment and are updated on a daily basis by the group, individual employees also have a good view on the KPI's. It is not (only) the supervisor that uses them to adjust specific actions.
- [ ] The team determines their KPI's in consultation with the supervisor and in line with the business objectives. It is clear to the team members how they can influence the achievement of the KPI's through their own actions and decisions. The supervisor and the team (members) follow the KPI's and consult on proposals for improvement. Team members feel responsible for performance indicators and the team meets regularly to discuss continuous improvement activities. They have the knowledge and tools to monitor and adjust KPI's.
- [ ] KPI's are developed and monitored by the team on a permanent basis. They autonomously take the initiative to develop and implement corrective and improvement actions based on performance. The management is informed and has the primary task to clarify the direction and the framework for the teams. Within this framework of vision and strategy, the operational teams and their members are free agents in terms of how they will successfully perform and reach/exceed their own targets.

41. **Autonomy:** Teams are provided with maximum liberty as the context allows, to ensure efficient production as well as team development, learning and continuous improvement. Teams work with authority and responsibility.

- [ ] The operational manager assigns tasks to individual employees and supervises their execution.
- [ ] Individual employees receive work instructions without a kind of group or team being involved. As a consequence, employees work alongside each other, not together.
- [ ] Groups of individual employees structurally monitor the activities and take appropriate actions if adjustments are needed. People work closely together and the interdependence and connections are strong. The manager actively participates and acts as a group coach rather than a hierarchical superior. The groups of individual employees have autonomy to determine the work approach, the division and organisation of tasks.
- [ ] The team organises itself, both in terms of internal operations and goals and in terms of external contacts, outside of the own team. Depending on the aspirations and needs of individual employees, a team can easily switch between competencies and tasks in which the burden and capacity of each individual are respected. Teams manage themselves autonomously and have acquired the necessary skills to translate this into their work organization.
- [ ] Teams are assembled in a very agile fashion. When the composition of team changes, the team members can easily arrange the work through mutual consultation. Even if there are potential conflicts of interest between the collective and the individual, people on the shop floor succeed in resolving and managing these conflicts. The teams systematically work closely together at the shop floor, and a lot of knowledge and information is exchanged across the teams.

Leadership

A clear vision and strategy are well deployed and new leadership roles have been developed.

42. **Vision & Strategy:** Leaders stimulate the organization to be flexible and change-oriented. They actively promote an eagerness to develop oneself through open communication about future opportunities. Clear and repetitive follow-up on vision and strategy takes place.

- [ ] Management informs all individual employees on the results and long-term vision on an annual basis. No relation is made to the daily job context of individual employees. Company information is provided in a one-directional way, with little room for discussion.
- [ ] Management regularly provides updates on company results and vision. Strategy and projects are reported as well. Initiatives are set up to keep individual employees informed.
- [ ] Management engages in explaining the vision and strategy and in finding the links between individual employees and the company's vision and strategy.
- [ ] Management and teams discuss the vision and strategy as well as the way individual employees can contribute to the realisation of these goals, but also on the impact these goals have on them and how that might create opportunities. Management succeeds in stimulating and motivating everyone through the links with the company vision.
- [ ] In collaborative team discussions all teams define the way they contribute to the realisation of the future vision and strategy set out by top management. Individual employees understand the interaction between different projects, departments, teams, etc. and how they can collaborate.

43. **Horizontal & vertical direction:** All leadership levels - certainly middle layers - take up a role in developing individual employees and teams towards strong and flexible production environments, where expectations and targets are clear and energy is invested in the engagement and motivation of all staff. New leadership roles like coaches, mentor, etc. have been developed.

- [ ] The role of leadership throughout the organisation has not been clearly defined. The management takes on the full top-down responsibility.
- [ ] Leadership work is fully integrated into hierarchical positions. Middle layer managers and supervisors take care of task performance, relationships, change, etc.
- [ ] A part of the leadership work, namely the responsibility for tasks and people is shared, for example in self-organising teams. The top-level management initiates change and is externally focused. It holds the key responsibility for realising the company's vision and strategy.
- [ ] A far-reaching part of the leadership work, namely the responsibility for tasks, people and change is shared, for example in self-managing teams. The top-level management is externally focused and is considered a moral authority (referring to the way company values are embodied). It holds the key responsibility for realising the company's vision and strategy.
- [ ] The responsibility for tasks, people, change and external relations is generally and broadly shared on the basis of shared vision and competencies. Everyone can contribute to the maximum of their competencies. The top-level management is considered an international benchmark regarding moral authority and organisation-wide embedded responsibility for realising the company's vision and strategy.

Organisation

The organisation stimulates life-long learning and individual growth paths using an open communication philosophy between all hierarchical levels.

44. **Professional growth path development:** The organisation ensures a working environment that enables sustainable employability through life-long learning and facilitates all individual employees in defining their personal professional growth path.

- ☐ Individual employees feel engaged for the role and responsibilities they are required to take up. The main focus is on the operational execution and improvement of the way individual employees contribute and add value to product, process and the company as a whole.
- ☐ Individual employees primarily focus on value-add contribution and are engaged to do so. They are stimulated to not only contribute to the product and process with the competencies and skills they possess, but also to interact with each other and with management to create opportunities for further development.
- ☐ Value-add contribution is considered a given. The company and the individual employee consider each other partners in the development of skills, competencies and capabilities. They actively work together on life-long learning. The company assists the individual employee in setting up a professional growth path.
- ☐ Individual employees can openly discuss their aspirations and ambitions with management and supervisors, looking for win-wins or learning opportunities. Through open discussions, agreement can be found on the timing of the employee's professional growth path as well as on how the next step already can be prepared in the current role.
- ☐ Companies and individual employees form temporary but intense collaborations from which both benefit in their future steps. The employee's professional growth path and timings of necessary steps and related expertise acquisition are taken into account upfront and are seen as a valuable result of the collaboration.

45. **Open dialogue:** There is open communication between all hierarchical levels on diverse topics, including company results. Everyone is seen as a valued contributor and there is no 'us' versus 'them' atmosphere.

- ☐ The information sharing between management and the employee (representatives) is carried out according to formal principles. There is hardly any cooperation, and the interaction is mainly limited to mandatory consultation moments.
- ☐ Individual employee representatives have a direct line with management. There is a willingness and openness to address urgent questions or specific projects on an ad-hoc basis outside of the scheduled consultation moments.
- ☐ Not only individual employee representatives, but also individual employees themselves, have an open communication line with management and managers. Both ad-hoc issues and project specific issues can be discussed.
- ☐ All individual employees can consult with supervisors and management about the vision, strategy & projects. There are open discussions about changes, in which all individual employees are involved at the appropriate moments.
- ☐ The boundaries between hierarchical layers have disappeared in all communication and consultation moments. Everyone collaborates as partners of the company. There is a joint effort to outline the future strategy and all interested parties can commit themselves to take on an additional role in innovative initiatives or projects.

46. Did you already realize projects or deliverables in context of this transformation area?

T5 - Additional Questions

- How do you involve operators in process improvement projects?

- How exactly is autonomy of people and/or teams implemented?

- How do you address each other within the organisation? Directly, via hierarchy, ...?

- How is the training approach for employees organised? Is it uniform for all types of employees?

- Who makes team charters (if any)? (by a leader in the team or the whole team?)

- How do you work with these charters (e.g., does this come up in Objectives interviews?)

- What was the reason for drawing up the team charter? (Is it shared with other teams? Do they also use team charters?)

- How is the "conflict of interest" dealt with? Who makes decisions?

- How is the communication between the team and the Leadership level? Who ultimately makes decisions?

- To what extent are team roles and their development for the coming years discussed with managers?

- To what extent are individual roles and their development for the coming years discussed with managers?

- How does the leadership role of middle management evolve in the company? (Do they engage, motivate, coach, mentor individual employees and/or teams?)

Transformation 6 – Smart Manufacturing

Smart Manufacturing can be defined as the combination of the smart use of people's capabilities, the smart use of technology and the deployment of a (self-) learning production system. Smart manufacturing entities focus on customer-oriented product quality, services, delivery times and reliability through a shop floor organisation which is flexible, digitised, automated and fully connected with the organization and the value chain. The purpose is to create maximum efficiency, flexibility and value creation of machine operators and employees on the shop floor.

Human-Machine Interaction

The company designs its shop floor processes such that they are able to exploit the full potential offered by user-friendly, automated, intelligent and flexible human–machine interaction, ranging from digital connected machines to using real-time connected info carriers, cobots, robots, etc.

47. **From rigid automation to flexible manufacturing:** Shop floor people and intelligent machines work side by side on the shop floor for maximum efficiency and flexibility.

- ☐ Manufacturing equipment works on a stand-alone basis without any automation solutions.
- ☐ Key manufacturing equipment and automation solutions are combined into Manufacturing Cells connected to a digital platform.
- ☐ Machines can launch and perform simple and/or repetitive tasks in a digital and automated way.
- ☐ Intelligent use of real-time information enables efficient and flexible automation, communication and production planning.
- ☐ Advanced and automated planning and operation of digitally connected manufacturing equipment guarantees maximum efficiency and flexibility levels.

48. **Shop floor tasks:** Shop floor people, automations and intelligent machines work side by side on the shop floor for maximum efficiency.

- ☐ No automations or robotic systems are present at the shop floor.
- ☐ Specific repetitive and tedious manufacturing tasks are performed by industrial automations and/or robotic systems.
- ☐ Intelligent automated machines, cobots and/or robots are present. They enable individual employees to spend less time on tedious jobs enabling them to take on more complex tasks.
- ☐ Intelligent automated machines, cobots and/or robots perform simple and/or repetitive tasks while also supporting parts of the complex tasks of the individual employee.
- ☐ Intelligent automated machines, cobots and/or robots work alongside individual employees for maximum employee and customer value creation.

Manufacturing Planning & Control Processes

The company uses self-managed manufacturing and quality control systems in order to “organize for complexity”, i.e., being able to adapt quickly to changing orders and customer requests without always having to go in rush order status. Smart manufacturing KPI’s are used as an essential monitoring and improvement tool for the shop floor to support high levels of productivity and flexibility.

49. **Flexible & quick response:** (Self-managed) quick response planning & production systems enable the company to adapt quickly to changing orders and customer request whilst at the same time keeping short throughput times.

- [ ] The company applies a Make to Stock approach of as large batch sizes as possible, minimising the number of line changeovers. The feedback of customers and suppliers is not used to improve manufacturing processes.
- [ ] Manufacturing to stock of small batch sizes, with the exception of specials which are manufactured to order and this within a manually planned manufacturing system. The feedback of customers and suppliers is hardly used to improve manufacturing processes.
- [ ] The company manufactures to order large batch sizes and/or minimises changeover times between batches using a manual, digitally supported manufacturing planning system. The feedback of customers and suppliers is sometimes used to improve manufacturing processes.
- [ ] The company manufactures to order small batch sizes and/or minimises changeover times between batches using an automatically planned manufacturing system. The feedback of customers and suppliers is actively used to improve manufacturing processes. The company has executed first experiments around data analytics and automated decision making through Machine Learning and Artificial Intelligence is being implemented.
- [ ] The company manufactures to order 'lot size 1' batch sizes and/or minimises changeover times between batches using an automatically planned manufacturing system. The feedback of customers and suppliers is automatically used to improve manufacturing processes. Data analytics are integrated within decision support systems and automated decision making through Machine Learning and Artificial Intelligence is being implemented.

50. **First time right:** Self-managed quality and process control systems enable the company to adapt quickly to changing orders and customer requests without jeopardizing quality levels.

- [ ] Quality assurance is achieved by inspecting every single product.
- [ ] Quality inspection techniques and statistical models are used to improve quality.
- [ ] Key manufacturing processes are monitored in order to control and predict product quality.
- [ ] Widespread, real-time monitoring of manufacturing processes along with automated feedback-based actions guarantee First Time Right production.
- [ ] Knowledge on the relationship between manufacturing parameters and final product quality enables First Time Right in 'lot size 1' environments or in manufacturing environments needing quick changeovers.

51. **KPI visualisation & management:** Real-time smart manufacturing KPI’s are used to monitor, assess and improve the company’s performance.

- [ ] KPI's are defined on an ad-hoc basis, but not monitored at regular intervals.
- [ ] A basic set of KPI's has been defined and they are monitored at quarterly intervals.
- [ ] Smart KPI's are being used to monitor and/or evaluate the manufacturing processes at regular intervals.
- [ ] Smart KPI's as well as correction policies are used on a daily basis on the shop floor to monitor and improve the manufacturing processes.
- [ ] KPI's are calculated and displayed in real-time to improve and steer output, quality, lead time and efficiency of the shop floor and improve the manufacturing processes.

52. Did you already realize projects or deliverables in context of this transformation area?

T6 - Additional Questions

- What quality improvements have you made on the shop floor in recent years?

- To what extent have you been able to shorten the lead time on the shop floor in recent years?

- How do you ensure that individual employees need to spend less time on routine tasks and can focus more on the execution of more complex tasks?

- To what extent do you reduce the changeover times between the batches?

- To what extent is the feedback from customers and suppliers used to improve production processes?

Transformation 7 – Value Chain-Oriented Open Factory

Innovations of the highest quality and using the most complex technologies are increasingly being carried out by self-organizing networks. Networks are interlinked organizations that generate, acquire and integrate specific knowledge and skills to co-create new solutions, products and/or technologies. Self-organisation refers to the ability of these networks to combine and recombine the learned skills based on a flexible and de-centralised management. In a world of exponentially increasing technology developments and fast changing customer demands, companies can no longer depend exclusively on proprietary research and resources. They develop their products, manufacturing processes and services with the complete value chain in mind. Individual producers increasingly need to enable co-creation thereby expanding innovative capabilities. Factories are evolving from solo-players to networked organisations that share both risk and capital.

Cooperation and Partnerships

The organisation is structured to be agile and open towards various cooperation and partnership initiatives in order to enable co-creation, create demand-driven value chains and increase the factory's innovative capabilities.

53. **Internal Innovation Network:** The organisation itself works as an innovation network to allow for an innovative environment.

- [ ] No innovation plan or structure is present, innovations happen coincidentally.
- [ ] Innovations are realized by a small number of people. They only happen when specific challenges need to be addressed.
- [ ] An innovation plan is defined and new ideas are welcomed through open communication structures.
- [ ] A management system supports and visualises the idea generation and execution process included in the innovation plan.
- [ ] A multi-dimensional innovation plan targeting both short to long term impacts is both supported and executed by teams throughout the whole of the organisation.

54. **Partnership-driven innovation:** Networks of innovation are actively used by the factory as a way to combine and recombine internal as well as external knowledge to reach the position of an innovation leader.

- [ ] The organisation has no R&D partnerships.
- [ ] The organisation creates R&D partnerships if an opportunity occurs.
- [ ] The organisation has some R&D partnerships with whom they share or whom they use to obtain access to key resources or knowledge.
- [ ] The organisation has a multitude of structural R&D partnerships that are drawn upon in order to gain access to external knowledge required to realise innovations.
- [ ] The organisation acts and is recognized as an innovation leader within a broad, international network expanding beyond its own competences.

55. **Supply chain governance:** Agile supply chain structures enable high flexibility to cope with rapid changes in demand.

- [ ] The supply chain is not designed to allow change.
- [ ] Changes to the supply chain can be made on the long term.
- [ ] Some parts of the supply chain can be changed on a project-by-project basis.
- [ ] A small fixed supply chain is supplemented by new partners within a project-based approach.
- [ ] The supply chain is a flexible network to be adapted as services require.

External Expertise & Knowledge Management

To offer individualized and state-of-the-art products, the needs, demands and knowledge beyond the company's borders must be tapped into.

56. **Beyond customer and supplier needs:** The company has a broad stakeholder perspective beyond customer and supplier needs.

- [ ] Besides customers and suppliers no other stakeholders are actively approached by the company.
- [ ] Relevant stakeholder groups are identified and approached on a sporadic basis in a defensive and reactive manner.
- [ ] Individual stakeholders are identified and actively involved in specific activities.
- [ ] The needs of a multitude of stakeholders are being managed and considered in a systematic way.
- [ ] A multi-dimensional innovation plan targeting both short to long term impacts is both supported and executed by teams throughout the whole of the organisation.

57. **External knowledge management:** Companies screen, capture and integrate external knowledge on new technologies, ICT- tools, finances, markets, etc. to be able to adapt to changes in its environment.

- [ ] External knowledge is only available at the level of individual employees and is not stored centrally.
- [ ] There are sporadic impulses for collecting and storing external knowledge.
- [ ] First elements of an external knowledge management system have been introduced.
- [ ] A formal external knowledge management system is implemented and actively used.
- [ ] Every individual employee works intrinsically and in a self-controlled manner, contributing in a role as a kind of trend watcher and transfers acquired knowledge to colleagues in a formal and informal way.

58. Did you already realize projects or deliverables in context of this transformation area?

T7 - Additional Questions

- Exactly how do you approach innovation/R&D collaborations, in which important information and resources are shared or used?

- How do you manage externally acquired knowledge?

- What are the main external stakeholders that you take into account in your business operations?

Your Company

59. Company Name:

60. Manufacturing Sector:

61. Company Information – Does your company belong to one of the following categories?

☐ Medium-Sized
Staff headcount: < 250
Turnover: ≤ € 50 m
Balance sheet total: ≤ € 43 m

☐ Small
Staff headcount: < 50
Turnover: ≤ € 10 m
Balance sheet total: ≤ € 10 m

☐ Micro
Staff headcount: < 10
Turnover: ≤ € 2 m
Balance sheet total: ≤ € 2 m

62. Country:

Contact Details

63. First Name:

64. Last Name:

65. Job Title:

66. E-Mail Address:

Feedback

67. The survey has helped me to have a better view of the challenges my company needs to overcome to become a Factory of the Future.

☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

68. The concepts used in the questionnaire (e.g., transformation, Factories of the Future) are clear to me.

☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

Could you please indicate which aspects were not sufficiently clear to you?

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