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Smart Supply Chain – Development of the equipment supplier in global value networks

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Abstract. Digitization and its effect on markets, production conditions, and intercompany interaction forces companies to adapt continuously in order to stay competitive. Factory equipment suppliers are especially affected by this development. Their customers expect them to digitalize their products and at the same time, request new service-based approaches in short periods. Ultimately, they are taking a new role within the automotive supply chain. With their smart products and solutions, factory equipment suppliers build the fundament to digitalize their customers. As suppliers of smart solutions, they will gain strategic importance in global value creation networks and smart supply chains. This paper examines the transformation of the equipment suppliers through the progressive networking of supply chains, using the automotive industry as an example. It shows how their new strategic role within the supply chain is developing and what requirements consequently arise.

Keywords: Global Supply Chain, Smart Supply Chain, Industry4.0, Smart Factory, Automotive, plant vendor development

1 Introduction

The topic of smart supply chains is becoming increasingly important as globalization progresses. The management of global value chains offers companies the opportunity to improve their processes continuously. In Addition, it enables new digital business models based on digital services. For this, the central prerequisite is the availability of real-time production, product, and logistical processes data along the supply chain. In a first step, this concerns the equipment suppliers, who enable the digitalization of their customers with smart products and solutions. Due to this, factory suppliers in close-knit value-adding networks and global supply chains will gain strategic importance in the future. Current developments in this area can be easily observed in the automotive sector, since global procurement and production have been established here for a long time. This industry is changing dynamically due to new competitors and trends such as mass customization or electro mobility.

Using the German automotive industry as an example, this paper shows how the role of equipment suppliers is changing as supply chains become increasingly networked. Building on this, this study derives implications from the individual companies and describes how factory equipment suppliers in particular are increasingly integrated into their supply chains. The results are based on a two-stage survey, which involved equipment suppliers, OEMs, Tier1 and Tier 2/n suppliers.

2 Related Works

The global automotive industry is undergoing radical changes and confronting companies with increasingly complex challenges at ever-shortening intervals [1]. When buying a new car, the gaining importance of electro mobility, the increasing individualization of vehicles at constant costs, decreasing delivery times or new competitors such as Waymo or Uber are becoming important criteria for customers [2]. Considering the shortening product life cycles, the level of reaction speed of both the automobile manufacturer and the associated global supply chain protagonists is important for the future competitiveness of automobile manufacturers [3]. On the one hand, the goal is to expand the existing high process stability while reducing the amount of capital tied up in the entire process. On the other hand, it is important to make use of the technological opportunities rising as the digitalization proceeds.

Digitalization not only allows the reduction of inventories through increased transparency, but also enables individual product data to be shared and used along the global supply chain [1, 4, 5]. Important requirements for this are smart products and services offered by the factory suppliers. Their increasing range of services is more and more perceived as a success factor in the course of networked value creation.

As a result, equipment suppliers are not only gaining importance as suppliers of relevant production data, but are also opening up the potential for production optimization. They are increasingly prepared to not only sell their products, but also to operate, maintain, and dispose of them on behalf of the customer [6]. In the context of smart supply chain management these activities are becoming increasingly important for automobile manufacturers, as the required time windows are largely predictable [7-9]. The high market power of the original equipment manufacturers (OEMs) requesting these new services from their equipment suppliers drives the role change of the equipment supplier within the global supply chain structure.

3 Methodic Procedure

In order to be able to make as precise a statement as possible on the development of the role of the supplier, a multi-stage approach was chosen. In the first step, a structural analysis of the automotive industry over the levels Tier 2/n, Tier 1 and OEM is conducted. Additionally, current technological and social trends are identified at a high aggregation level and relevant fields of action are derived accordingly.

In the second step, the current activities of the individual actors in these fields of action are examined and classified with regard to their potential for change in the supply chain. In addition, the expected developments during the next five to ten years are surveyed in expert interviews. At the same time, the current focal points of the activities and expectations of the suppliers are taken up from their points of view.

In the third and final stage, the findings obtained through individual surveys are confirmed and expanded by a group of 17 high-level executives and as a result, development theses are derived.
These theses are validated in an online survey with 167 participants from 79 different companies. In total, the participants are assigned to the individual stages of the supply chain as follows (Figure 1):

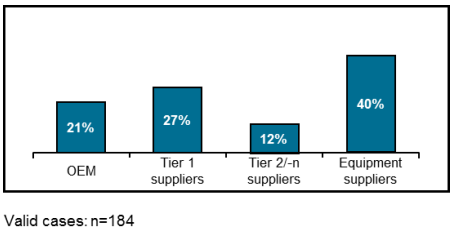

Fig. 1. Classification of the participants

4 Results

The automotive industry is currently undergoing profound change. For a long time, manufacturers focused on the continuous improvement of existing technologies and the optimization of traditional business models. Currently the four main observable areas driving the transformation are:

- Digitalization of the manufacturing process
- Assistance systems and autonomous driving in connected vehicles
- Search for alternative drive concepts, in particular electric mobility
- New mobility concepts, especially in the area of car sharing

Many of those surveyed expect politicians to influence the sales market, Figure 2: The promotion of electro mobility, driving bans on internal combustion engines, stricter exhaust emissions values, and changes in the laws governing autonomous driving will significantly change the framework conditions. However, the timing and scope are currently very unclear, which increases the uncertainty for all parties involved.

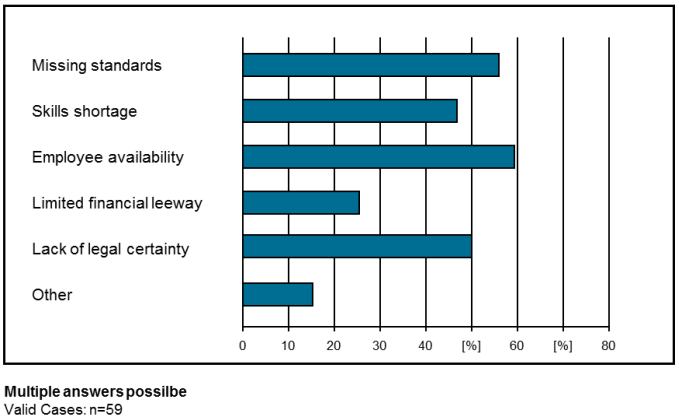

Fig. 2. Challenges of digitalization

The uncertain future of the internal combustion engine is the subject of intensive discussions among OEMs, the directly affected supplier sector, and the directly affected factory equipment suppliers. This has an impact above all on the strategic orientation of the companies. The expert interviews and the online survey confirmed that all respondents are intensively dealing with these issues (Figure 3).

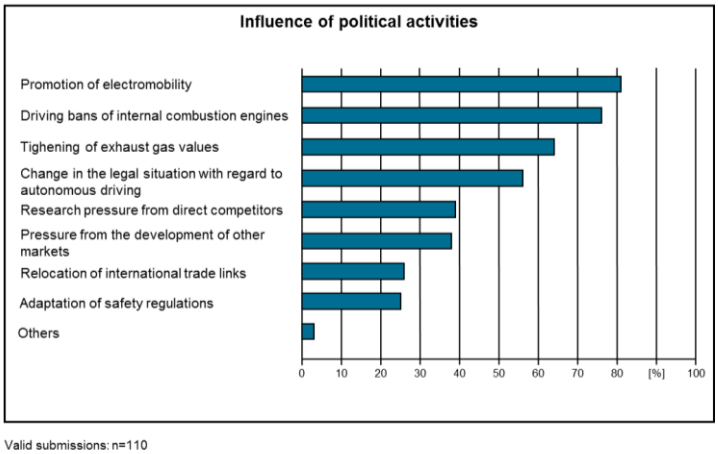

Fig. 3. Influence of political activities

Many of those asked expect political interference on the sales markets worldwide. The promotion of electro mobility, driving bans, stricter exhaust emission value limits and changes in the laws governing autonomous driving will significantly change the current framework conditions. However, the period and scope of the changes mentioned is still unclear, which increases the uncertainty for all parties involved. Nevertheless, automobile manufacturers expect their vertical range of manufacturing to continue to decline.

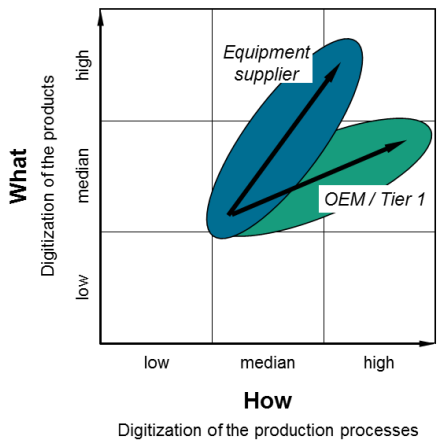

Fig. 4. Development trails of OEM/Tier1 and equipment suppliers

In comparison, the equipment suppliers, usually the machine manufacturers assess their own changes driven by the ongoing digitalization in business and general conditions as particularly far-reaching. Both their new role in the automotive supply chain and the shorter technology life cycles are increasing the pressure to innovate on factory equipment manufacturers. In addition to this pressure, there is also an increasingly fierce competition with high costs. Digitalization itself opens up two strategic directions for equipment suppliers (Figure 4):

- Better process control: Digitalization increases the transparency of manufacturing and logistics processes, both in terms of real-time capability and in the depth of information. Both can make the processes more secure, but only if the information is shared.
- New business models: Digitalization supports remote operations. This enables a variety of operator models in which the equipment suppliers themselves bear the costs of acquisition, operation, maintenance and disposal. They can then invoice their customers for usage-related expenses.

Both directions increase the technical requirements of the products from the factory suppliers. They become the key provider of production data. At the same time, this also brings the independent value of operator data and their ownership and usage rights into the focus of the transfers.

Many equipment suppliers combine these approaches and see their dual role as factory operators and equipment suppliers as an opportunity. They use new concepts and solutions both internally, to improve their own production, and as demonstrators for a "factory of the future" to display their technological expertise to potential customers. Smart products from the suppliers will become the "digitalization enabler" - the indispensable prerequisite for a smart supply chain. From a technical point of view, digitalized processes allow for a higher transparency of the supply chain. Figure 5 shows the growing need of Tier 1/n suppliers for a high level of process knowledge and thus the importance

of product digitalization for equipment suppliers. Digitalized products could also reduce the effort for production planning and control. However, this only becomes effective through a stronger exchange of information between supply chain actors for demand, capacity and order progress data. Automating the cross-company information exchange reduces the transaction costs associated with the transfer of information to the partners involved [1].

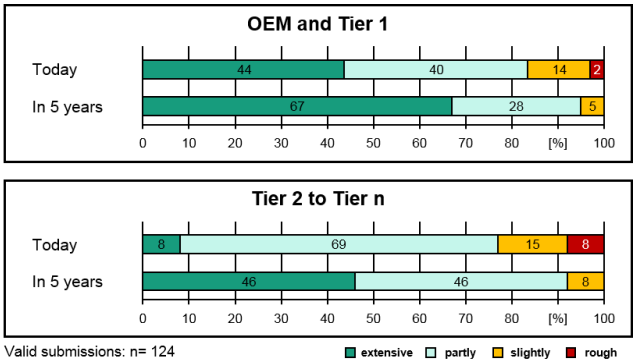

Fig. 5. Knowledge of OEM and Tier 1/n suppliers about the technical process parameters that essentially determine their product quality

Because of the developments described above, the role and range of services offered by factory suppliers is undergoing sustainable change. This begins with the spread of the operator (business) models, which are also increasingly becoming the standard for custom-made products and specialized equipment. As a result, OEMs are increasingly demanding that equipment suppliers contribute to continuous production improvements and expect new products to be instantly integrated into the existing production IT. Due to the described forward integration of automobile manufacturers, it is increasingly conceivable that some equipment suppliers will take over the operation and optimization of entire factories. This trend is reinforced by the development towards globally standardized and uniformly equipped factories. In connection with the extensive conversion to operator models in a global context and the increased transparency resulting from various smart supply chain approaches, there are various effects on global supply chains from the supplier's perspective. On the one hand, opportunities to return, recycle, and re-use products have to be organized, and the logistics chain developed for this purpose. On the other hand, there are strong changes with regard to the required delivery times. As shown in figure 6, delivery windows with the range of a week for new plants are often standard, but within the next 5 years this will become the exception, rather than the rule. Instead, the ranges will decrease to days first and finally to minutes.

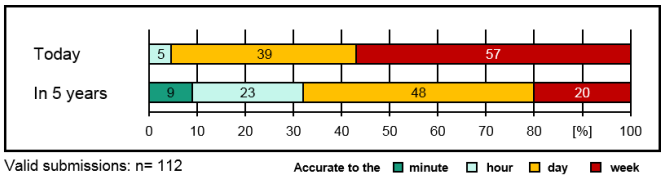

Fig. 6. Delivery time of equipment supplier for crucial parts

In the case of the operator models, topics such as installation and commissioning, maintenance, servicing, and replacement are taken over by the plant manufacturer. The ability to meet precise deadlines down to the hour must be strengthened, since these activities must be carried out in narrow time windows predefined by the customer. Customers along the entire value chain expect shorter delivery times, but also attach increasing importance to hourly predictions of delivery dates. In addition, maintenance activities must be carried out within narrow, predefined time windows, because otherwise high contractual penalties are imminent. The demands on the supply chain of equipment suppliers are increasing accordingly. In the future, they will have to build up or expand their own competence in supply chain management, at least for the automotive sector. Operator models are also becoming increasingly standard for custom-made products. In summary, suppliers are increasingly integrated into the supply chain and are taking over the operational activities, thus becoming their customers' global strategic partners.

Even though the experts surveyed emphasize the benefits of the integration of equipment suppliers, there are various arguments that delay the developments described. Although operator models on the part of the customer reduce tied assets, it is difficult to quantify the other financial effects due to a lack of reference examples. In addition, uncertain legal relationships are named as a restriction. Due to the lack of standards for data exchange, the restraint in data exchange in Europe is an additional obstacle. Finally, there is the question of dependence on individual equipment suppliers and the safeguarding of one's own expertise.

5 Conclusion

This example from the automotive industry shows how the role of equipment suppliers in global supply chains is strengthened. New technologies and business models lead to greater process responsibility and risk assumption by equipment suppliers and reduce the number of customers' tied-up assets. The change described clearly shows that the digitization of suppliers is only possible through the smart products of the plant suppliers. Closely meshed supply chains increasingly integrate suppliers as independent players in their own value-added chain and require a high degree of adherence to delivery dates. As the variety of products increases, delivery times and windows are expected to shorten at the same time. This means that hourly or daily delivery windows become standard even for outfitters. In order to validate the informative value of the results

presented here, further industries will have to be examined for these developments in the future. The exact role of the Tier2/n and Tier1 suppliers must be further questioned in detail. Furthermore, the question what kind of offers and services for equipment suppliers will actually be in demand in the future arises and which strategy promises success here.

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