Competitive priorities and capabilities: high-cost country case survey

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Abstract

Purpose – Globalization and the importance of emerging markets have increased the pressure of high-cost manufacturing locations to sustain operations. However, there are still some countries in which manufacturing is prospering despite high costs (like Germany, Sweden and Switzerland). This study examines seven competitive priorities through 24 different capabilities, using a case survey of four manufacturing companies located in Sweden. This study aims to develop a contemporary understanding from vital priorities and capabilities.

Design/methodology/approach – A case survey was conducted in four different-sized manufacturing companies in Sweden during the autumn of 2018. In total, the survey attracted 89 responses. Respondents were mainly middle managers and other management team members.

Findings – In general, companies assess the importance of manufacturing capabilities higher than performance and improvement. The authors' analysis shows that quality priority through product and process capabilities is ranked highest in terms of importance, performance and improvement. In addition, delivery capability shows a similarity with quality. At the other end, being lowest ranked are typically different flexibility and advertising capabilities. This study demonstrates with correlation analysis that most often capabilities have a positive correlation in terms of their importance, performance and improvement needs. Some capabilities show potential correlations across importance, performance and improvement.

Research limitations/implications – This research is limited to one high-cost environment and to four companies within that environment. Further research should examine the impact of the pandemic era on manufacturing priorities and capabilities.

Originality/value – In general, case surveys have relatively rarely been used in management studies. This research offers an alternative and deeper perspective from high-cost country manufacturing, as the responses are from numerous persons in management positions.

Keywords Capability, Priority, Manufacturing, High-cost, Survey

Paper type Research paper

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1. Introduction

Skinner (1969, 1974) was one of the first manufacturing scholars who noted that companies cannot solely be operated on the basis of efficiency objectives. Customers, time and costs are all involved and intervened in business decisions, and there are typically trade-offs between them. Later, Skinner (1986) concluded that cost efficiency and productivity cannot be achieved through cost-cutting alone; there should be other ways to develop these capabilities as well. Because of globalization, US manufacturing industry in 1990s was demanding more agile responses to the competition challenge (Goldman *et al.*, 1995). Agility refers to the ability of companies to be flexible in their operations, still making a profit. It is about being able to produce yet unknown and new products in a flexible manner (Goldman *et al.*, 1995). However, these observations and demands for changes were not enough. Manufacturing in developed economies was under challenge and constantly losing market share to emerging markets. Pinheiro and Yang (2018) reported declines in all over the developed world since the late 1990s in both manufacturing jobs and manufacturing share of the total labor market. This was because of not only cost competitiveness issues but also growth opportunities, that emerging markets offered. The loss of manufacturing jobs in developed countries is substantial in some industrial areas, such as more traditional manufacturing (Houseman, 2018). However, it could be concluded that not all countries or regions have lost in the process (Simon, 2017). Some industries have even offered growth opportunities. These have been examined in recent years, and backshoring as well as reshoring have both been a reality in many companies (Engström *et al.*, 2018; Hilletofth *et al.*, 2019; Johansson and Olhager, 2018; Lund and Steen, 2020; Wiesmann, *et al.*, 2017). To understand this phenomenon and the prospects of developed country manufacturing, we need more research addressing the factors underlying competitiveness (Ascic *et al.*, 2022; Edh Mirzaei *et al.*, 2021). It is a complex phenomenon with numerous manufacturing priorities involved within the overall competitiveness equation (Dangayach and Deshmukh, 2001; Martín-Peña and Díaz-Garrido, 2008; Platts *et al.*, 1998; Sansone *et al.*, 2017). Some priorities and their associated capabilities must be accorded more weight in developed economies than in emerging ones. Gold *et al.* (2017) argued, based on surveys within European manufacturing firms, that emerging country manufacturing within Europe is keen to advance within flexibility dimensions, while also fulfilling sustainability demands. However, developed country manufacturing in Europe is more concentrated on cost efficiency and being proactive in terms of sustainability. Previous research does not find a difference in the nucleus of manufacturing priorities – quality is still at the core, and everything is built upon it (Gold *et al.*, 2017; Bortolotti *et al.*, 2015).

The changes in developed country manufacturing should be seen from a long-term perspective and through the crises and shocks which it has been through (Lorentz *et al.*, 2016). In the past two decades, developed countries have been struggling with debt challenges, and crises have occurred in both the USA and Europe, which among other things have affected domestic market demand and created uncertainty in raw material and components prices as well as availability (Christopher and Holweg, 2011). Similarly, the dot.com crisis in 2001 affected many innovative manufacturing industries and their prospects. These crises have affected manufacturing and supply networks in developed countries so much that remaining could be considered as surviving, and companies in such contexts have somehow adapted their operations to the new realities (Blome and Schoenherr, 2011; Jüttner and Maklan, 2011). Lorentz *et al.* (2016) found that, among Finnish small and medium-sized industrial companies, those concentrating on engineering and services were more recession proof and robust in the 2008–2009 crisis than companies which only are subcontractors. This presented research is a further step to that of Lorentz *et al.* (2016), and

we are interested in gaining information about what kind of manufacturing priorities and capabilities companies focus on in developed country manufacturing. Competitive manufacturers in developed countries cannot be characterized only through innovation and technological competence (e.g. the model of Bolwijn and Kumpe, 1990). Success comes through the combination of various capabilities, which is the departure in this study and were our contribution arises from. Our interest is both in large corporations and medium-sized companies. Our research sample is from Sweden, a country which has been rather successful in its manufacturing-based exports and showing growth, even in the previous decade. By comparison, Finland has not been growing its exports after 2009, continuing with a merely levelled off development.

This research is structured as follows: The literature on manufacturing strategy, capabilities and performance is considered in Section 2. The research methodology and environment follow in Section 3. The empirical survey is presented and analyzed in Section 4 and data based on case company surveys completed. In addition to conventional analysis, this section also contains correlation analyses of the importance, performance and improvement of manufacturing capabilities. The research is concluded in Section 5, where future research avenues are suggested.

2. Manufacturing strategy, capabilities and performance

It is crucial for all manufacturing firms to serve its customers by creating value for them and, by doing so, build a long-lasting competitive advantage (Battistella *et al.*, 2017; Koufteros *et al.*, 2002). This is achieved by identifying, developing and continuously improving the most essential manufacturing capabilities, in other words, working with manufacturing strategy implementation (Sansone *et al.*, 2020a; Slack and Lewis, 2019; Tempelmayr *et al.*, 2019). The core of a competitive advantage lies in the ability to differentiate from competitors through products or services and in the ability to operate at a lower cost by using less resources (Christopher, 1998). By understanding how customer value is created and delivered, a company can organize and manage its manufacturing function in the most suitable manner (Hilletofth, 2011). Manufacturing capabilities with the highest impact on organizational performance should be targeted, and the capabilities developed should be aligned with customer requirements to achieve a competitive advantage (Hilmola *et al.*, 2015; Liu and Liang, 2015; Gupta *et al.*, 2020). Organizational performance is directly linked to the developed manufacturing capabilities (Größler and Grübner, 2006).

The pursued manufacturing capabilities are influenced by the external environment (Bolwijn and Kumpe, 1990; Größler and Grübner, 2006; Ketokivi *et al.*, 2017; Sansone *et al.*, 2020b). Manufacturing environments can be distinguished from one another in various ways, and one way is to distinguish between developed (high-cost) and emerging (low-cost) environments (Ketokivi *et al.*, 2017; Sergi *et al.*, 2019). Manufacturing functions located in emerging low-cost environments tend to focus on cost efficiency and compete on price, while manufacturing functions located in developed high-cost environments tend to focus on enhancing the value offering and compete by providing the highest value for money (Arunachalam *et al.*, 2019). This implies finding opportunities to avoid price competition by differentiating the value offering through developing manufacturing capabilities related to quality, delivery, flexibility, service, innovation or sustainability (Ascic *et al.*, 2022; Johansson and Olhager, 2018; Lund and Steen, 2020).

In recent years, companies have been substantially adapting their manufacturing and supply network to current realities. One of them being the recent trade war between the USA and China, which brought about an understanding that manufacturing and sourcing need to

be at least enlarged outside of China to nearby countries like Cambodia and Vietnam (Shih, 2020; Aba, 2021). After 2020 and because of the coronavirus pandemic, companies have been struggling with transportation and logistics (Sheffi, 2021), which has resulted in favoring domestic or nearby manufacturing locations and supplier networks (Shih, 2020). Inventories are no longer seen as an item to be minimized but as an enabler of operations and sales (Butt, 2021; Sheffi, 2021). Further developments in 2022 in terms of military conflict within Ukraine, as well as coronavirus closures in China, have fostered the debate on more local and domestic supply chains (Simchi-Levi and Haren, 2022). In addition, the future role of Russia and China in global supply chains is being questioned and analyzed thoroughly in companies (Simchi-Levi and Haren, 2022; Jagtap *et al.*, 2022). The developments of 2022 have further increased the costs of operating global supply chains. However, it is difficult, if not impossible, to change supply chain configurations right away, but for long-term planning, these events have significant effects.

Manufacturing strategy implementation consists of two core elements, competitive priorities and decision-making (Dangayach and Deshmukh, 2001; Martín-Peña and Díaz-Garrido, 2008; Platts *et al.*, 1998). The competitive priorities are the intended capabilities that the manufacturing function must emphasize to fulfil the overall business strategy, while decision-making is the series of improvement actions that the manufacturing function decides to implement and that determine the actual manufacturing capabilities (Hayes and Wheelwright, 1984; Miller and Roth, 1994; Größler and Grübner, 2006). The manufacturing function transforms resources and competences into manufacturing capabilities based on targeted competitive priorities (Größler and Grübner, 2006). Thus, manufacturing capabilities play a key role in terms of strategically aligning skills and resources to fulfil customer needs (Koufteros *et al.*, 2002).

There are several models in the literature explaining the process of developing manufacturing capabilities. Two most frequent models are the trade-off model and the cumulative model (Singh *et al.*, 2015). In the trade-off model, certain capabilities are regarded as more important than others from a strategic perspective. This perspective suggests that manufacturing capabilities are developed individually. Accordingly, the management team needs to carefully assess which manufacturing capabilities should be prioritized (Sum *et al.*, 2012). However, as the competitive environment is increasingly intensifying, this results in a situation in which manufacturing companies must excel in multiple capabilities. From this perspective, it is arguable that manufacturing capabilities are built on each other cumulatively and developed in parallel (Avella *et al.*, 2009; Schroeder *et al.*, 2011). A cumulative view is adopted in this paper.

3. Research methodology

The literature on manufacturing capabilities is very extensive (Dangayach and Deshmukh, 2001; Frohlich and Dixon, 2001; Sansone *et al.*, 2017). Accordingly, a survey framework was constructed based on a recent framework of manufacturing capabilities developed through a systematic literature review (Sansone *et al.*, 2017) and later revised through empirical research in a developed high-cost environment (Sansone *et al.*, 2020a/b). The framework is based on seven generally agreed upon manufacturing priorities (Table 1). These competitive priorities are connected to 24 manufacturing capabilities, which are analyzed in the empirical part of this study. The survey was targeted as a case of four Swedish manufacturing companies on a survey basis. They all operate in a developed high-cost environment. Responses were gathered in autumn 2018 using an internet-based survey technique. Respondents received a unique mail link to respond to the questions. Reminder emails were sent twice. Companies taking part in this survey could be considered to

Table 1.
Survey framework using 7 priorities and 24 capabilities

Priority	Capability		Definition
Cost	1	Cost efficiency	The ability to provide products at low cost
	2	Process efficiency	The ability to maximize utilization of process resources
	3	Flow efficiency	The ability to maximize the process output
Quality	4	Product quality	The ability to provide high performance products
	5	Process quality	The ability to provide products with consistent quality
	6	Product durability	The ability to provide durable products
Delivery	7	Delivery dependability	The ability to deliver on time
	8	Delivery speed	The ability to deliver in a short time
	9	Delivery flexibility	The ability to change delivery times and quantities within the agreed upon time
Flexibility	10	Volume flexibility	The ability to respond to changes in market demand
	11	Product mix flexibility	The ability to change the manufacturing product mix
	12	Product flexibility	The ability to customize products based on customer requirements
	13	Product line flexibility	The ability to provide a wide range of products with different features
	14	Employee flexibility	The ability of employees to perform different types of tasks
Service	15	Customer service	The ability to provide customers with service prior to product delivery
	16	After sale service	The ability to provide customers with service after product delivery
	17	Advertising	The ability to advertise and promote products effectively
	18	Distribution	The ability to distribute products broadly
Innovation	19	Product innovation	The ability to develop and introduce new products
	20	Technology innovation	The ability to develop and implement new technologies
	21	Service innovation	The ability to develop and introduce new services
	22	Market innovation	The ability to find and exploit new markets and opportunities
Sustainability	23	Product sustainability	The ability to provide sustainable products
	24	Process sustainability	The ability to provide products in a sustainable manner

Source: Adapted from Sansone *et al.* (2017; 2020a, 2020b)

represent diverse industries and sizes in terms of revenue (from a few million to nearly a billion EUR), number of employees (from tens to well above 2,000) and assets. All four companies mainly operate in European markets (one company also has coverage in North America) and within the business-to-business segment. One company of the four operates with short delivery lead times (deliver to order), while three others have medium to long customer lead times, as they make or engineer to order. Case company surveys are not common among case study research (Eisenhardt and Graebner, 2007; Voss *et al.*, 2002) but are used occasionally. Eriksson *et al.* (2015) used a survey within a forest harvesting company and its 74 contractors, to better understand the downstream requirements among contractors and how to adapt the wood harvesting supply chain to them for higher performance. Earlier, Childerhouse and Towill (2003) gathered information from 32 automotive industry companies concerning their simplified material flow and supply chain integration. Their data analysis was mostly quantitative and combined multiple data gathering sources, like interviews, time series data and questionnaires.

The survey was able to gather in total 89 usable answers (survey was sent directly to 122 respondents, and 5 responses were eventually excluded from analysis, as they were not complete), and they came from the respondents as follows: company 1 answered 49 times through different individuals (55%), company 2, in turn, provided 16 answers (18%), company 3 17 answers (19.1%), and company 4 the lowest amount of 7 responses (7.9%). Responses were mainly from middle managers and management team members. They represented both the supply (purchasing, production, assembly, distribution, supply chain and general management) and the demand (e.g. product development and sales) side of the business (respondents were nearly equally distributed between these two). Organization of companies do differ nowadays a lot, but from classical departments/functions, respondents nearly equally represented Research and Development, Production, Procurement and Supply Chain. Because of the nature of a case survey (companies collaborating with university in co-production research projects), the response rate of survey was very high (73%; not including excluded answers), and only very few respondents refused to answer.

The survey consisted of three different parts concerning the priorities and capabilities given in Table 1. In the first part, we were interested in the importance of capabilities. Respondents were asked to "rate the capabilities in terms of how important they are for the company's competitiveness (from 1 = not important to 5 = very important)". In the second part, we were interested in the performance of capabilities. Respondents were asked to "rate the capabilities in terms of how well the company is currently performing on them (from 1 = very low performance to 5 = very high performance)." In the final part of the survey, we were interested in the improvement of capabilities. Respondents were asked to "rate the capabilities in terms of how much the company is currently working on improving them (from 1 = no improvement efforts to 5 = many improvement efforts)." In total, respondents answered to 72 questions, and in all these questions, we used Likert scales from one to five.

4. Case survey analysis

In the survey, there were three different areas, which the respondents were asked to be evaluate. The first concerned the importance of 24 competitive priorities and capabilities for the particular company, while the second subarea was designed to determine how companies performed on these 24 different items. The final survey area asked how the company was working to improve on these 24 different priorities and capabilities. All asked survey capabilities were introduced in Table 1.

Interestingly, overall, the responding companies indicated that many of the 24 items were extremely important for their company (average of all responses of 24 items was 4.12). As can

be noted from Figure 1, many capabilities are considered so important that the average response is four or higher. In fact, the total number of such items is 14. Above the average of 4.5, there are still five capabilities ("5. Process quality", "4. Product quality", "20. Technology innovation", "19. Product innovation" and "7. Delivery dependability"). The lowest ranked capability has an average of 3.36 ("13. Product line flexibility"), which could still be considered as moderately high. Two latter areas were much lower, where the performance subarea (average of all responses of 24 items was 3.44) was higher than the improvement subarea (average of 3.28). This lower performance is apparent from Figures 2 and 3. There are only two capabilities in the performance area with an average above four ("4. Product quality" and "6. Product durability"), and in the improvement area, there is not even one (highest is with an average of 3.89 in "4. Product quality"). There is one capability with an average below three in the performance area ("2. Process efficiency") and five in the improvement area ("14. Employee flexibility", "11. Product mix flexibility", "18. Distribution", "9. Delivery flexibility" and "17. Advertising"). Based on this high- and low-performing analysis, it could be stated that high-cost companies typically consider numerous areas as important, but they become less and less so as we proceed to performance and eventually to improvement. In fact, in the improvement area, respondents see many areas which require only very low attention in the future.

If all question areas are examined together, then there are some capabilities which are at the highest positions in all three areas. For example, "4. Product quality" is the highest performer in this regard – it is second highest in importance, highest in performance and highest in improvement. Rather similar is "5. Process quality", which is highest in the importance area for all capabilities, fifth highest in performance and third in improvement. Together with these two is "7. Delivery dependability", which is fifth highest in importance, third highest in performance and fifth highest in improvement. All these three mentioned capabilities are interesting in that they already have high importance and high performance, but respondents still see further improvement needs. These three factors could be considered as the key ones among case survey companies in terms of achieving sustainable

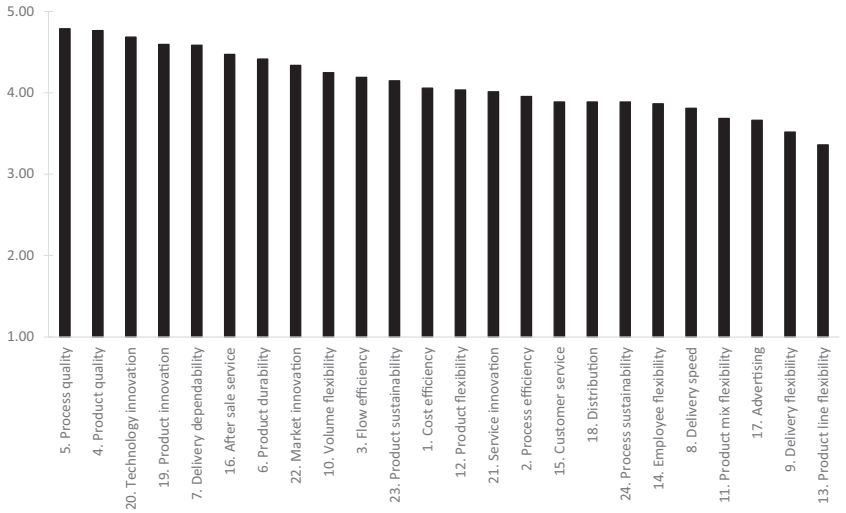

Figure 1. Importance of manufacturing capabilities (descending order) among respondents ($n = 89$, average)

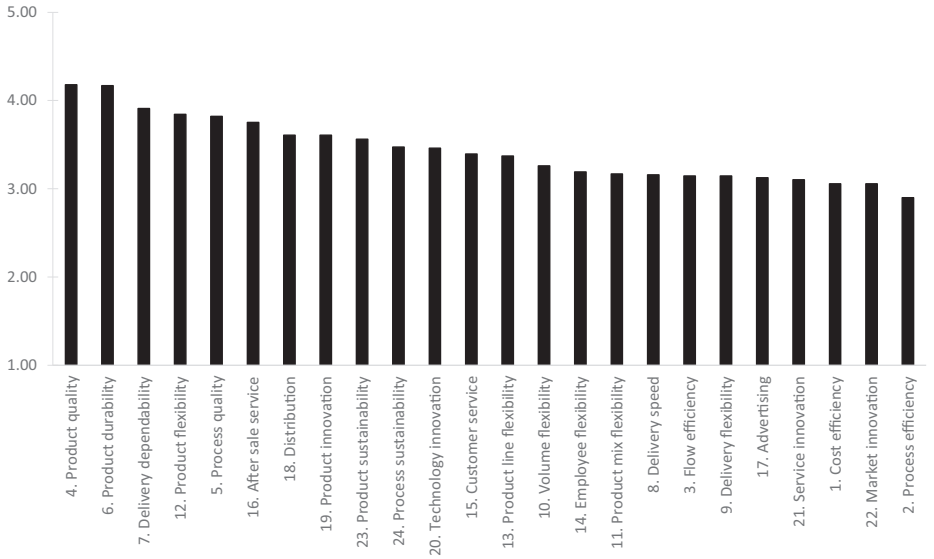

Figure 2.
Current performance of capabilities (descending order) among respondents ($n = 89$, average)

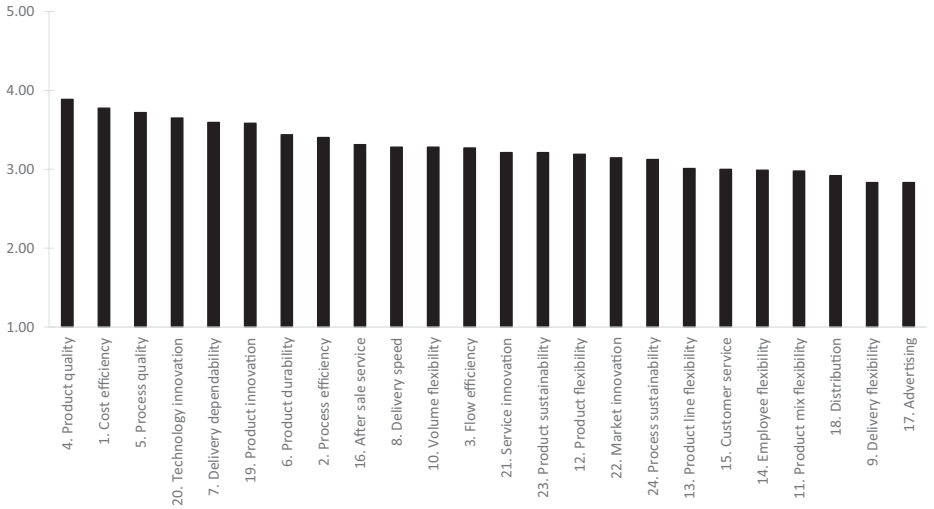

Figure 3.
Extent of improving capabilities (descending order) among respondent companies ($n = 89$, average)

high performance within high-cost manufacturing. Performance in these is already high but will be an objective for further improvements.

There are three capabilities which are, most of the time, in three subsections as lower ranked. One of the lowest performing is "17. Advertising", which is third lowest in importance, fifth lowest in performance and lowest in improvement. Capability "9. Delivery flexibility" is similar, as it is second lowest in importance, sixth lowest in performance and second lowest again in improvement. Capability "11. Product mix flexibility" follows these two rather closely as fourth lowest in importance, ninth lowest in performance and fourth

lowest in improvement. Thus, these three lower-performing capabilities resemble those of higher-performing but with a small exception. None of these three lower ones are extremely low in their performance (second section of survey), but they do show very low ranks in importance and improvement. These three capabilities are connected to business-to-consumer markets and could be much less relevant for respondent companies, as they mostly represent business-to-business areas.

As both high and low-performing capabilities showing causalities within the same capabilities in the three different areas of the survey, the correlation analysis were completed between importance and performance as well as performance and improvement. As the Likert scale was from one to five in responses, it was justifiable to include only very high statistical significance correlations in the following (p-value being 0.001 or below). If lower significance levels would have been used (p-values of 0.01 or 0.05), then the causalities between capabilities would have been much higher, ranging from 35 to 125. However, these are doubtful in situations where the scale used does not have so many options, and it is in the end hard to tell how respondents see differences within the scales. Therefore, examining only very high significance levels is a well-justified and cautious approach.

Correlations were very few between importance and performance as can be seen from Figure 4. In total, they were ten, and six of them were between the same capabilities. All these correlations were positive (see Appendix for details). Correlations included some of the highest importance capabilities, like "20. Technology innovation" (third highest), "16. After sale service" (sixth highest), "22. Market innovation" (eighth highest) and "10. Volume flexibility" (ninth highest). Interestingly, the high importance of technology innovation is connected to high performance of the same item. However, the rest of the higher ranked capabilities are positively connected to distribution performance. Concerning the other correlations, they are simply causalities between the same items in importance and performance areas.

Correlations between performance and improvement of these capabilities were much higher in numbers, in total 19 (Figure 5). Five of these correlations were between same items, but as can be seen from Figure 5, a number of more diverse connections were present. It could be identified that two capabilities from performance have numerous connections to improvement. The highest number of connections is with "22. Market innovation", capability having causality with four improvement items. It should be noted that "22. Market innovation" is second lowest in performance capabilities, and based on the correlation model, its performance is linked to the improvement efforts of "8. Delivery speed", "9. Delivery flexibility", "10. Volume flexibility" and "22. Market innovation". From these four, not a

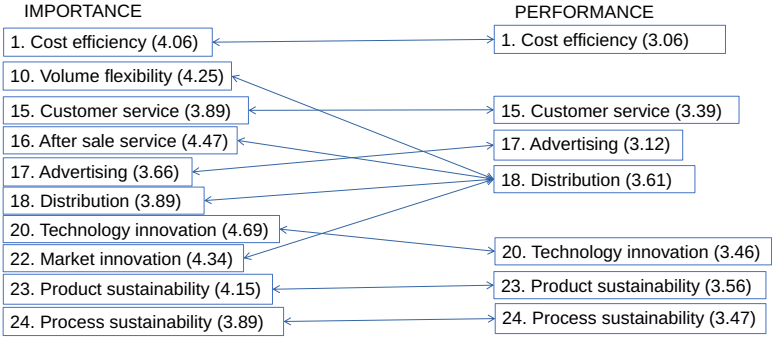

Figure 4.
Correlations between importance and performance capability subquestions (in parenthesis average of responses; all positive correlations and statistically significant at a level of 0.001)

single one is at the high end of the desired improvement efforts. Another higher correlation link capability in the performance area is "24. Process sustainability", which has three connections (with "4. Product quality", "23. Product sustainability" and "24. Process sustainability"). Again, "24. Process sustainability" is not high ranked within performance; however, from the improvement side, "4. Product quality" is the highest. Thus, if and when companies do address improvement efforts for product quality, it will impact positively on process sustainability. There are four other capabilities in the performance area, which have two connections each to the improvement side ("3. Flow efficiency", "17. Advertising", "19. Product innovation" and "23. Product sustainability"). From these two-link connections, most interesting is that of performance and from "3. Flow efficiency", which is connected to high-ranked improvement requiring capabilities such as "7. Delivery dependability" (fifth most important) and "20. Technology innovation" (fourth most important).

As correlation tables and graphs are merged with performance capability connections, many connections are lost, and only very limited ones remain (Figure 6). Of these three area correlation items, the most important in all three parts of the survey is capability of "20.

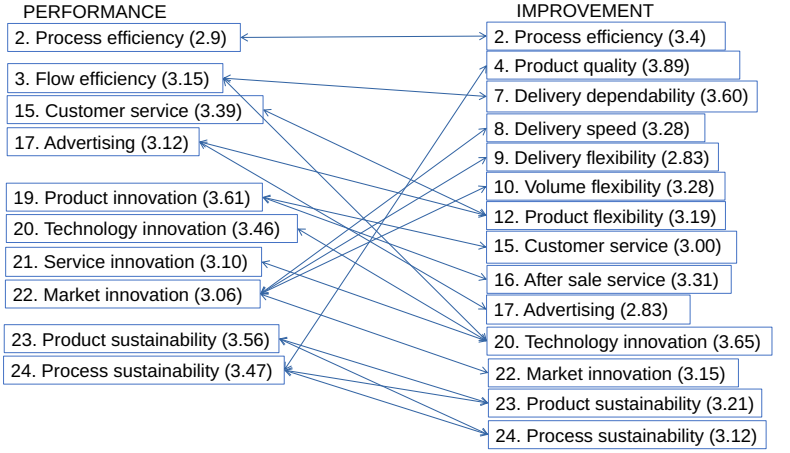

Figure 5.
Correlations between performance and improvement capability subquestions (in parenthesis average of responses; all positive correlations and statistically significant at level of 0.001)

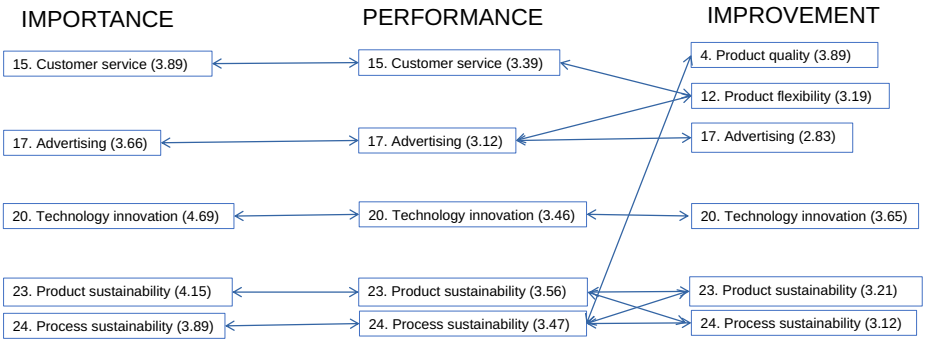

Figure 6.
Correlations combined with performance item to construct connections between importance, performance and improvement capabilities (in parenthesis average of responses; all positive correlations and statistically significant at level of 0.001)

Technology innovation" (3rd highest in importance, 11th in performance and 4th in improvement). Based on the correlation models, the higher its importance is ranked, the higher performance and improvement need. This could be considered as a cycle, which will feed on itself, and is key among high-cost manufacturing companies. Advertising is similar, as are both sustainability capabilities (product and process). Interestingly, sustainability capabilities are tied together, where the importance and performance of individual capabilities will lead to improvement needs in both. In addition, process sustainability has a logical connection to product quality. Figure 6 also illustrates that, rather understandably, capabilities "15. Customer service" and "17. Advertising" lead from importance and performance to "12. Product flexibility" improvement need. This could be understood through more interaction with customers, which will inevitably lead to new requirements, product and their variant needs. This all could be accomplished with customized products using flexible product designs.

5. Conclusions

Since the early writings of Skinner (1969, 1974) on manufacturing competitiveness, there has been ongoing debate about competitive priorities and capabilities. For this research work, we identified 7 priorities, which contained in total 24 priorities. The research concerned developed country manufacturing company priorities, and it was conducted as a case survey among four different sized companies. It was interesting to note that Swedish companies evaluated quality (both product and process) as highest in all considered subsections of the survey (importance, performance and improvement of priorities). In a similar manner, the ability to deliver on time (delivery dependability) was rated high in all three subsections. At the other end, the survey showed that advertising and flexibility (delivery and product mix) were rather low ranked in two subsections (importance and improvement). For performance, these were somewhat higher ranked.

The survey also indicated that companies see many priorities and capabilities as important, but this declines as we proceed to performance evaluation and ultimately where companies are working for improvement. Correlations between subsections also followed the general level of evaluation. There were fewer correlations (all positive) between importance and performance but more between performance and improvement. This could all mean that companies in general have already achieved high general performance in terms of capabilities, but their importance has not declined. However, on the basis of this study, it seems that a shift is taking place more on quality and delivery dimensions and excelling in them. This is fairly logical, considering other countries that are competitive in manufacturing-based exports and have high costs (Simon, 2017). For example, German and Swiss manufacturing exports qualify in these capabilities as well. These findings support the idea of an accumulation of competitiveness through the cumulative development of priorities over time (Avella *et al.*, 2009; Schroeder *et al.*, 2011) and where quality and delivery performance are at the very core (Bortolotti *et al.*, 2015). These findings have both theoretical and practical implications. Classic competitive priorities have not diminished, mastering them through competent management is as vital as before. In research, the core of the cumulative "sandcone model" still exists and provides a platform for the performance of manufacturing companies.

Across subsections and having correlations and causalities, it seems that few factors have the potential to route from importance to performance and eventually for improvement. Interestingly, product and process sustainability are such and they also in the end of causality routes lead companies to improve both these capabilities. In addition, process sustainability has a connection to the improvements addressed within product quality. This illustrates that sustainability and quality have a shared future path and indicate that further improvements in quality are based also on sustainability. There was also causality paths of

innovation and advertising detected, but these are mostly affecting this area only (advertising is having improvement linkage to product flexibility).

This research work comes with implications for practice. It seems like manufacturing companies desiring to be superior in developed economies should stress the importance of sustainability and quality and then separately develop innovation together with these two. There are causalities between these three capabilities in the correlation model. Besides these three capabilities, delivery performance is an important capability that somehow should be assured. Research work also has theoretical implications, suggesting that more research should focus on understanding the role and interrelationships of these manufacturing capabilities. This research has found some evidence from such phenomenon, but more research is needed.

This research, however, did not find an increasing role of cost competitiveness and sustainability, as Gold *et al.* (2017) found in the survey of two developed European countries concerning manufacturing. As stated in the correlation analysis of this study, a linkage was found from process sustainability (importance and performance) and product quality (improvement). In addition, efficiency showed some relatively higher needs in the improvement area. These could be indications that the analyzed case companies might have some minor similarities with the findings of Gold *et al.* (2017) but only in a rather marginal sense. As a research implication, it would be important to follow whether Swedish manufacturing companies in the future will start to move in this direction. Currently, the ongoing and numerous crises of 2022 could have already changed perceptions in this regard (Simchi-Levi and Haren, 2022).

As further research in the area, it would be important to examine the impact of the pandemic on manufacturing priorities and capabilities. This era has been argued to have favored larger corporations, where small and medium-sized companies have been on the losing end. In addition, the service branch must have been severely hurt. These examinations should be made in high-cost countries, which have been under pressure from Asian competition as the pandemic period hit harder, for instance, Europe and North America in terms of infections and lockdowns as well as restrictions. The weight of future research should in time be the pandemic maturing and as societies attempt to move out of the situation. This phase is vital for competitiveness in the forthcoming decade.

References

Aba, F.X.L. (2021), "Institutional change and macroeconomic variables in the ASEAN – Indonesia, Vietnam, and Cambodia: the effects of a trade war between China and USA", *Economies*, Vol. 9 No. 4, p. 195, doi: 10.3390/economies9040195.

Arunachalam, S., Bahadir, C., Bharadwaj, S. and Guesalaga, R. (2019), "New product introductions for low-income consumers in emerging markets", *Journal of the Academy of Marketing Science*, Vol. 48 No. 5, pp. 914-940, doi: 10.1007/s11747-019-00648-8.

Ascic, I., Ascic, J., Hilletofth, P., Pimenta, M.L. and Hilmola, O.-P. (2022), "An evaluation of critical capabilities and improvement areas for competitive manufacturing in a developed country environment", *Sustainability*, Vol. 14 No. 11, p. 6678, doi: 10.3390/su14116678.

Avella, L., Vazquez-Bustelo, D. and Fernandez, E. (2009), "Cumulative manufacturing capabilities: an extended model and new empirical evidence", *International Journal of Production Research*, Vol. 49 No. 3, pp. 707-729, doi: 10.1080/00207540903460224.

Battistella, C., DE Toni, A.F., De Zan, G. and Pessot, E. (2017), "Cultivating business model agility through focused capabilities: a multiple case study", *Journal of Business Research*, Vol. 73, pp. 65-82, doi: 10.1016/j.jbusres.2016.12.007.

Blome, C. and Schoenherr, T. (2011), "Supply chain risk management in financial crises – a multiple case-study approach", *International Journal of Production Economics*, Vol. 134 No. 1, pp. 43-57, doi: 10.1016/j.ijpe.2011.01.002.

Bolwijn, P.T. and Kumpe, T. (1990), "Manufacturing in the 1990s – productivity, flexibility and innovation", *Long Range Planning*, Vol. 23 No. 4, pp. 44-57, doi: 10.1016/0024-6301(90)90151-S.

Bortolotti, T., Danese, P., Flynn, B.B. and Romano, P. (2015), "Leveraging fitness and lean bundles to build the cumulative performance sand cone model", *International Journal of Production Economics*, Vol. 162, pp. 227-241, doi: 10.1016/j.ijpe.2014.09.014.

Butt, A.S. (2021), "Strategies to mitigate the impact of COVID-19 on supply chain disruptions: a multiple case analysis of buyers and distributors", *International Journal of Logistics Management, Forthcoming*, doi: 10.1108/IJLM-11-2020-0455.

Childerhouse, P. and Towill, D.R. (2003), "Simplified material flow holds the key to supply chain integration", *Omega*, Vol. 31 No. 1, pp. 17-27, doi: 10.1016/S0305-0483(02)00062-2.

Christopher, M. (1998), *Logistics and Supply Chain Management: Strategies for Reducing Costs and Improving Services*, Pitman Publishing, London.

Christopher, M. and Holweg, M. (2011), "Supply chain 2.0": managing supply chains in the era of turbulence", *International Journal of Physical Distribution and Logistics Management*, Vol. 41 No. 1, pp. 63-82, doi: 10.1108/09600031111101439.

Dangayach, G.S. and Deshmukh, S.G. (2001), "Manufacturing strategy: literature review and some issues", *International Journal of Operations and Production Management*, Vol. 21 No. 7, pp. 884-932, doi: 10.1108/01443570110393414.

Edh Mirzaei, N., Hilletofth, P. and Pal, R. (2021), "Challenges to competitive manufacturing in high-cost environments: checklist and insights from Swedish manufacturing firms", *Operations Management Research*, Vol. 14 Nos 3/4, pp. 272-292, doi: 10.1007/s12063-021-00193-0.

Eisenhardt, K.M. and Graebner, M.E. (2007), "Theory building from cases: opportunities and challenges", *Academy of Management Journal*, Vol. 50 No. 1, pp. 25-32, doi: 10.5465/amj.2007.24160888.

Engström, G., Sollander, K., Hilletofth, P. and Eriksson, D. (2018), "Reshoring drivers and barriers in the Swedish manufacturing industry", *Journal of Global Operations and Strategic Sourcing*, Vol. 11 No. 2, pp. 174-201, doi: 10.1108/JGOSS-06-2017-0014.

Eriksson, M., LeBel, L. and Lindroos, O. (2015), "Management of outsourced forest harvesting operations for better customer-contractor alignment", *Forest Policy and Economics*, Vol. 53, pp. 45-55, doi: 10.1016/j.forpol.2015.01.002.

Frohlich, M.T. and Dixon, J.R. (2001), "A taxonomy of manufacturing strategies revisited", *Journal of Operations Management*, Vol. 19 No. 5, pp. 541-558, doi: 10.1016/S0272-6963(01)00063-8.

Gold, S., Schodl, R. and Reiner, G. (2017), "Cumulative manufacturing capabilities in Europe: integrating sustainability into the sand cone model", *Journal of Cleaner Production*, Vol. 166, pp. 232-241, doi: 10.1016/j.jclepro.2017.08.028.

Goldman, S.L., Nagel, R.N. and Preiss, K. (1995), *Agile Competitors and Virtual Organizations*, Van Nostrand Reinhold (Thompson Publishing), New York, NY.

Größler, A. and Grübner, A. (2006), "An empirical model of the relationships between manufacturing capabilities", *International Journal of Operations and Production Management*, Vol. 26 No. 5, pp. 458-485, doi: 10.1108/01443570610659865.

Gupta, S., Drave, V.A., Dwivedi, Y.K., Baabdullah, A.M. and Ismagilova, E. (2020), "Achieving superior organizational performance via big data predictive analytics: a dynamic capability view", *Industrial Marketing Management*, Vol. 90, pp. 581-592, doi: 10.1016/j.indmarman.2019.11.009.

Hayes, R.H. and Wheelwright, S.C. (1984), *Restoring Our Competitive Edge: Competing through Manufacturing*, Wiley, New York, NY.

Hilletofth, P. (2011), "Demand-supply chain management: industrial survival recipe for new decade", *Industrial Management and Data Systems*, Vol. 111 No. 2, pp. 184-211, doi: 10.1108/02635571111115137.

Hilletofth, P., Eriksson, D., Tate, W. and Kinkel, S. (2019), "Right-shoring: making resilient offshoring and reshoring decisions", *Journal of Purchasing and Supply Management*, Vol. 25 No. 3, doi: 10.1016/j.pursup.2019.100540.

Hilmola, O.-P., Lorentz, H., Hilletofth, P. and Malmsten, J. (2015), "Manufacturing strategy in SMEs and its performance implications", *Industrial Management and Data Systems*, Vol. 115 No. 6, pp. 1004-1021, doi: 10.1108/IMDS-12-2014-0380.

Houseman, S.N. (2018), *Understanding the Decline of US Manufacturing Employment. Upjohn Institute Working Paper 18-287*, W.E. Upjohn Institute for Employment Research, Kalamazoo, MI. doi: 10.17848/wp18-287.

Jagtap, S., Trollman, H., Trollman, F., Garcia-Garcia, G., Parra-López, C., Duong, L., Martindale, W., Munekata, P.E.S., Lorenzo, J.M., Hdaifeh, A., Hassoun, A., Salonitis, K. and Afy-Shararah, M. (2022), "The Russia-Ukraine conflict: its implications for the global food supply chains", *Foods*, Vol. 11 No. 14, p. 2098, doi: 10.3390/foods11142098.

Johansson, M. and Olhager, J. (2018), "Manufacturing relocation through offshoring and backshoring: the case of Sweden", *Journal of Manufacturing Technology Management*, Vol. 29 No. 4, pp. 637-657, doi: 10.1108/JMTM-01-2017-0006.

Jüttner, U. and Maklan, S. (2011), "Supply chain resilience in the global financial crisis: an empirical study", *Supply Chain Management: An International Journal*, Vol. 16 No. 4, pp. 246-259, doi: 10.1108/13598541111139062.

Ketokivi, M., Turkulainen, V., Seppälä, T., Rouvinen, P. and Ali-Yrkkö, J. (2017), "Why locate manufacturing in a high-cost country? A case study of 35 production location decisions", *Journal of Operations Management*, Vols. 49-51 No. 1, pp. 20-30, doi: 10.1016/j.jom.2016.12.005.

Koufteros, X.A., Vonderembse, M.A. and Doll, W.J. (2002), "Examining the competitive capabilities of manufacturing firms", *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 9 No. 2, pp. 256-282, doi: 10.1207/S15328007SEM0902_6.

Liu, Y. and Liang, L. (2015), "Evaluating and developing resource-based operations strategy for competitive advantage: an exploratory study of Finnish high-tech manufacturing industries", *International Journal of Production Research*, Vol. 53 No. 4, pp. 1019-1037, doi: 10.1080/00207543.2014.932936.

Lorentz, H., Hilmola, O.-P., Malmsten, J. and Srai, J.S. (2016), "Cluster analysis application for understanding SME manufacturing strategies", *Expert Systems with Applications*, Vol. 66, pp. 176-188, doi: 10.1016/j.eswa.2016.09.016.

Lund, H.B. and Steen, M. (2020), "Make at home or abroad? Manufacturing reshoring through a GPN lens: a Norwegian case study", *Geoforum*, Vol. 113, pp. 154-164, doi: 10.1016/j.geoforum.2020.04.015.

Martín-Peña, M. and Díaz-Garrido, E. (2008), "A taxonomy of manufacturing strategies in Spanish companies", *International Journal of Operations and Production Management*, Vol. 28 No. 5, pp. 455-477, doi: 10.1108/01443570810867204.

Miller, J.G. and Roth, A.V. (1994), "A taxonomy of manufacturing strategies", *Management Science*, Vol. 40 No. 3, pp. 285-304, doi: 10.1287/mnsc.40.3.285.

Pinheiro, R. and Yang, M. (2018), "The evolution of the labor share across developed countries", Federal Reserve Bank of Cleveland, Economic Commentary, Number 2018-08, available at: www.clevelandfed.org/en/newsroom-and-events/publications/economic-commentary/2018-economic-commentaries/ec-201808-evolution-of-the-labor-share-across-developed-countries.aspx (accessed January 31 2022).

Platts, K.W., Mills, J.F., Bourne, M.C., Neely, A.D., Richards, A.H. and Gregory, M.J. (1998), "Testing manufacturing strategy formulation processes", *International Journal of Production Economics*, Vols. 56-57, pp. 517-523, doi: 10.1016/S0925-5273(97)00134-5.

Sansone, C., Hilletofth, P. and Eriksson, D. (2017), "Critical operations capabilities for competitive manufacturing: a systematic review", *Industrial Management and Data Systems*, Vol. 117 No. 5, pp. 801-837, doi: 10.1108/IMDS-02-2016-0066.

Sansone, C., Hilletofth, P. and Eriksson, D. (2020a), "Evaluation of critical operations capabilities for competitive manufacturing in a high-cost environment", *Journal of Global Operations and Strategic Sourcing*, Vol. 13 No. 3, pp. 229-250, doi: 10.1108/JGOSS-10-2019-0055.

Sansone, C., Hilletofth, P. and Eriksson, D. (2020b), "Critical operations capabilities for competitive manufacturing in a high-cost environment: a multiple case study", *Operations and Supply Chain Management: An International Journal*, Vol. 13 No. 1, pp. 94-107, doi: 10.31387/oscm0400255.

Schroeder, R., Shah, R. and Xiaosong Peng, D. (2011), "The cumulative capability 'sand cone' model revisited: a new perspective for manufacturing strategy", *International Journal of Production Research*, Vol. 49 No. 16, pp. 4879-4901, doi: 10.1080/00207543.2010.509116.

Sergi, B.S., Popkova, E.G., Bogoviz, A.V. and Ragulina, J.V. (2019), "Entrepreneurship and economic growth: the experience of developed and developing countries", *Entrepreneurship and Development in the 21st Century*, pp. 3-32, doi: 10.1108/978-1-78973-233-720191002.

Sheffi, Y. (2021), "What everyone gets wrong about the never-ending COVID-19 supply chain crisis", *MIT Sloan Management Review*, Vol. 63 No. 1, pp. 1-5.

Shih, W.C. (2020), "Global supply chains in a post-pandemic world", Harvard Business Review, Sept.-Oct.2020, available at: https://hbr.org/2020/09/global-supply-chains-in-a-post-pandemic-world (accessed 25 November 2021).

Simchi-Levi, D. and Haren, P. (2022), "How the war in Ukraine is further disrupting global supply chains", Harvard Business Review, 17th of March 2022, available at: https://hbr.org/2022/03/how-the-war-in-ukraine-is-further-disrupting-global-supply-chains (accessed 16 August 2022).

Simon, H. (2017), "Why Germany still has so many middle-class manufacturing jobs?", *Harvard Business Review*, Vol. 2, pp. 2-4.

Singh, P.J., Wiengarten, F., Nand, A.A. and Betts, T. (2015), "Beyond the trade-off and cumulative capabilities models: alternative models of operations strategy", *International Journal of Production Research*, Vol. 53 No. 13, pp. 4001-4020, doi: 10.1080/00207543.2014.983277.

Skinner, W. (1969), "Manufacturing – missing link in corporate strategy", *Harvard Business Review*, Vol. 47 No. 3, pp. 136-145.

Skinner, W. (1974), "The focused factory", *Harvard Business Review*, Vol. 52 No. 3, pp. 113-121.

Skinner, W. (1986), "The productivity paradox", *Harvard Business Review*, Vol. 64 No. 4, pp. 55-59.

Slack, N. and Lewis, M. (2019), *Operations Strategy*, Pearson, London.

Sum, C.C., Singh, P.J. and Heng, H.Y. (2012), "An examination of the cumulative capabilities model in selected Asia-Pacific countries", *Production Planning and Control*, Vol. 23 Nos 10/11, pp. 735-753, doi: 10.1080/09537287.2011.642135.

Tempelmayr, D., Ehrlinger, D., Stadlmann, C., Überwimmer, M., Mang, S. and Biedersberger, A. (2019), "The performance effect of dynamic capabilities in servitizing companies", *Journal of International Business Research and Marketing*, Vol. 4 No. 6, pp. 42-48, doi: 10.18775/jibrm.1849-8558.2015.46.3005.

Voss, C., Tsikriktsis, N. and Frohlich, M. (2002), "Case research in operations management", *International Journal of Operations and Production Management*, Vol. 22 No. 2, pp. 195-219, doi: 10.1108/01443570210414329.

Wiesmann, B., Snoei, J.R., Hilletofth, P. and Eriksson, D. (2017), "Drivers and barriers to reshoring: a literature review on offshoring in reverse", *European Business Review*, Vol. 29 No. 1, pp. 15-42, doi: 10.1108/EBR-03-2016-0050.

Further reading

Balsas, C.J.L. (2015), "Sustainable transportation planning, a new academic specialization in the USA", *International Journal of Transportation Science and Technology*, Vol. 4 No. 1, pp. 1-15, doi: 10.1260/2046-0430.4.1.1.

Appendix. Correlation tables (*** denotes statistical significance with 0.001 level)

Table A1. Importance-performance of capabilities

	1-imp.	2-imp.	3-imp.	4-imp.	5-imp.	6-imp.	7-imp.	8-imp.	9-imp.	10-imp.	11-imp.	12-imp.
1-perf.	0.357***	0.032	0.032	−0.103	−0.022	−0.041	0.139	0.057	0.173	0.198	0.067	0.172
2-perf.	0.177	0.038	0.217	0.188	0.026	−0.125	−0.035	−0.229	−0.162	0.03	0.063	−0.118
3-perf.	−0.066	−0.133	0.144	0.089	0.072	−0.158	0.009	−0.117	−0.108	−0.003	−0.038	−0.152
4-perf.	0.15	−0.089	0.155	0.146	0.117	−0.047	−0.01	−0.225	−0.265	0.02	−0.12	0.143
5-perf.	−0.002	−0.104	0.001	0.075	0.196	0.139	0.009	0.017	−0.06	−0.001	−0.03	0.126
6-perf.	−0.112	−0.05	−0.09	0.062	0.043	0.081	−0.022	−0.067	−0.149	0.066	−0.005	−0.01
7-perf.	0.144	0.118	−0.041	−0.054	0.058	0.007	0.288	0.282	0.181	0.272	0.325	0.004
8-perf.	0.082	−0.005	0.037	−0.101	0.218	−0.077	0.137	0.243	0.115	0.212	0.066	0.075
9-perf.	0.209	0.01	0.067	−0.228	0.052	−0.13	0.227	0.219	0.178	0.243	0.148	0.058
10-perf.	0.254	−0.244	0.01	−0.101	−0.027	−0.074	0.053	0.081	−0.148	0.103	0.079	0.045
11-perf.	0.125	−0.212	0.113	−0.11	0.034	−0.076	0.076	0.015	−0.18	0.116	0.11	−0.135
12-perf.	−0.032	−0.059	0.185	−0.069	−0.053	−0.048	0.026	−0.106	−0.14	0.096	0.075	0.082
13-perf.	−0.041	−0.025	0.135	0.024	0.055	−0.193	0.149	0.021	−0.146	0.073	−0.049	−0.137
14-perf.	0.11	0.084	0.052	−0.098	−0.011	−0.193	0.169	0.126	0.223	0.274	0.151	0.186
15-perf.	−0.14	0.13	0.262	−0.064	0.21	0.066	0.23	0.052	0.034	0.171	0.016	0.161
16-perf.	0.141	0	0.151	0.09	−0.076	−0.02	0.09	0.014	−0.071	0.118	−0.041	0.218
17-perf.	0.131	0.15	0.245	−0.21	0.097	0.106	0.302	0.193	0.225	0.331	0.269	0.32
18-perf.	0.083	0.178	0.176	0.096	0.016	0.04	0.217	0.192	0.186	0.343***	0.249	0.23
19-perf.	0.187	0.007	0.082	−0.038	0.094	0.1	0.098	−0.059	−0.028	0.145	0.134	−0.012
20-perf.	0.333	−0.029	0.191	0.042	0.195	0.036	−0.054	−0.189	−0.05	0.023	−0.001	−0.03
21-perf.	0.285	−0.086	0.201	0.003	0.063	0.093	−0.022	0.061	−0.031	0.082	0.085	−0.052
22-perf.	0.323	−0.025	0.031	−0.205	0.002	0.075	0.136	0.097	0.106	0.219	0.17	0.128
23-perf.	−0.068	0.02	−0.026	−0.006	−0.009	0.026	0.211	0.071	0.045	0.053	−0.135	0.093
24-perf.	0.039	0.132	0.035	−0.064	0.054	−0.033	0.191	0.132	0.182	0.071	−0.066	−0.006

(continued)

	13-imp.	14-imp.	15-imp.	16-imp.	17-imp.	18-imp.	19-imp.	20-imp.	21-imp.	22-imp.	23-imp.	24-imp.
1-perf.	−0.045	−0.057	−0.107	0.086	0.052	0.129	−0.037	0.073	−0.001	0.08	0.062	0.034
2-perf.	−0.178	−0.109	0	0.035	−0.179	0	−0.012	0.232	0.027	−0.106	−0.248	−0.191
3-perf.	−0.06	0.039	0.006	−0.151	−0.043	−0.084	−0.015	0.135	−0.097	−0.055	−0.141	−0.095
4-perf.	−0.286	−0.147	−0.134	−0.078	−0.231	−0.047	−0.256	0.207	−0.093	−0.138	0.014	−0.119
5-perf.	−0.078	−0.035	0.159	0.125	−0.047	0.028	−0.151	0.101	0.034	−0.011	−0.012	−0.013
6-perf.	−0.042	−0.097	0.062	−0.047	−0.179	0.072	−0.054	0.113	−0.134	−0.136	−0.004	−0.046
7-perf.	0.328	0.083	0.22	0.322	0.309	0.21	0.175	−0.011	0.309	0.219	0.065	0.087
8-perf.	0.06	0.118	0.32	0.177	0.199	0.09	0.127	0.279	0.254	0.326	0.104	0.171
9-perf.	0.165	−0.02	0.271	0.259	0.234	0.006	0.029	0.102	0.167	0.324	0.073	0.122
10-perf.	−0.078	−0.164	−0.017	0.018	0.043	0.082	0.104	0.113	0.023	0.162	0.071	−0.147
11-perf.	−0.006	−0.031	−0.058	−0.056	−0.064	0.069	0.223	0.163	0.087	0.07	0.031	−0.148
12-perf.	−0.013	0.133	−0.007	−0.21	0.016	0.016	0.111	0.105	−0.068	0.129	−0.129	0.096
13-perf.	0.042	0.065	−0.17	−0.267	−0.085	−0.142	0.028	0.193	−0.019	0.015	−0.178	−0.08
14-perf.	0.056	0.116	0.013	0.166	0.17	0.262	0.202	0.083	0.195	0.169	0.151	0.145
15-perf.	0.185	0.28	0.402***	0.114	0.207	0.069	0.157	0.195	0.113	0.168	0.217	0.126
16-perf.	−0.086	−0.216	−0.101	0.224	−0.071	−0.067	0.069	0.22	0.108	0.132	0.038	−0.103
17-perf.	0.116	0.199	0.239	0.219	0.358***	0.191	0.056	0.236	0.181	0.261	0.149	0.216
18-perf.	0.225	−0.063	0.09	0.347***	0.189	0.444***	0.118	0	0.284	0.426***	0.173	0.106
19-perf.	0.034	−0.084	0.052	0.094	0.175	0.128	0.08	0.16	0.216	0.047	0.002	−0.074
20-perf.	−0.263	−0.055	−0.153	0.023	−0.063	−0.033	−0.059	0.38***	0.217	−0.011	−0.041	−0.017
21-perf.	−0.163	−0.045	−0.103	0.038	−0.029	0.009	−0.04	0.181	0.282	0.081	0.088	0.012
22-perf.	−0.032	0.072	0.006	0.292	0.243	0.206	0.019	0.151	0.293	0.253	0.146	0.02
23-perf.	−0.052	0.039	0.02	−0.21	0.034	−0.004	−0.057	−0.028	−0.172	−0.129	0.443***	0.229
24-perf.	−0.042	0.13	0.192	−0.119	0.103	−0.039	−0.129	0.075	−0.021	−0.158	0.283	0.38***

Table A1.

Table A2.
Performance-improvement of capabilities

	1-perf.	2-perf.	3-perf.	4-perf.	5-perf.	6-perf.	7-perf.	8-perf.	9-perf.	10-perf.	11-perf.	12-perf.
1-impr.	0.243	0.221	0.169	0.219	0.021	0.025	−0.023	0.039	−0.016	0.028	0.02	0.038
2-impr.	0.135	0.352***	0.26	0.224	0.025	0.059	−0.126	0.17	0.112	0.152	0.287	0.115
3-impr.	0.118	0.243	0.29	0.171	0.022	0.122	−0.027	0.087	0.109	−0.003	0.178	0.164
4-impr.	0.056	0.239	0.025	0.311	0.22	0.18	−0.082	−0.087	0.028	0.026	0.106	0.147
5-impr.	−0.114	0.251	0.206	0.312	0.253	0.161	−0.164	0.014	−0.043	0.086	0.128	0.101
6-impr.	0.054	0.028	0.051	−0.021	0.125	0.116	0.206	−0.017	0.058	0.134	0.058	−0.03
7-impr.	0.113	0.077	0.433***	0.01	−0.079	−0.02	0.253	0.024	0.126	0.049	0.068	−0.042
8-impr.	0.128	−0.006	0.161	−0.009	0.083	−0.147	0.324	0.332	0.3	0.159	0.04	−0.095
9-impr.	0.012	0.021	0.142	0.055	0.148	−0.158	0.253	0.324	0.317	0.253	0.06	−0.291
10-impr.	−0.017	0.117	0.187	−0.043	0.143	0.068	0.235	0.222	0.271	0.235	0.297	−0.095
11-impr.	−0.012	−0.032	0.218	−0.033	−0.041	−0.098	0.072	0.076	0.16	0.082	0.239	−0.036
12-impr.	0.032	−0.085	0.078	−0.047	0.08	−0.186	0.195	0.28	0.321	0.127	−0.129	0.047
13-impr.	−0.058	0.016	−0.018	−0.086	0.057	−0.154	0.247	0.115	0.191	−0.019	−0.054	−0.206
14-impr.	0.014	−0.056	0.075	−0.073	0.03	0.163	0.127	0.043	−0.014	−0.137	0.003	−0.136
15-impr.	0.043	0.16	0.108	−0.041	0.143	0.043	0.305	0.218	0.087	0.03	0	−0.191
16-impr.	0.071	0.159	0.084	−0.038	0.001	−0.034	0.317	0.035	0.241	0.205	0.129	−0.155
17-impr.	0.039	−0.063	0.018	−0.123	0.039	−0.07	0.155	0.296	0.153	0.013	−0.008	−0.021
18-impr.	0.035	0.122	0.032	−0.182	0.049	0.025	0.237	0.119	0	0.058	0.123	−0.147
19-impr.	−0.088	0.169	0.167	−0.029	0.062	0.071	0.105	0.027	−0.065	0.102	0.338	0.036
20-impr.	0.094	0.308	0.35***	0.255	0.219	0.058	−0.036	0.122	0.142	0.192	0.162	0.137
21-impr.	0.034	0.202	0.155	0.027	0.123	−0.021	0.284	0.179	0.29	0.125	0.206	−0.078
22-impr.	−0.009	0.004	0.143	−0.006	0.07	−0.236	0.1	0.238	0.209	0.077	0.059	−0.072
23-impr.	0.119	−0.015	0.177	−0.046	0.04	0.195	0.196	−0.054	0.036	0.1	0.124	−0.03
24-impr.	0.09	0.03	0.19	−0.121	0.017	0.171	0.241	0.061	0.041	−0.116	0.002	−0.02

(*continued*)

	13-perf.	14-perf.	15-perf.	16-perf.	17-perf.	18-perf.	19-perf.	20-perf.	21-perf.	22-perf.	23-perf.	24-perf.
1-impr.	−0.008	0.027	0.064	0.044	0.095	−0.124	0.137	0.228	0.12	0.154	−0.023	0.062
2-impr.	−0.005	0.084	0.126	−0.066	0.141	−0.068	0.214	0.232	0.053	0.118	0.1	0.171
3-impr.	0.202	0.257	0.067	−0.163	0.067	−0.046	0.191	0.165	−0.042	0.022	0.128	0.231
4-impr.	−0.005	0.151	0.063	0.122	0.292	0.001	0.247	0.302	0.17	0.208	0.303	0.356***
5-impr.	0.106	0.087	0.16	0.121	0.13	−0.055	0.221	0.287	0.034	0.064	0.132	0.134
6-impr.	−0.056	0.201	0.11	0.197	0.334	0.155	0.293	0.107	0.143	0.22	0.174	0.19
7-impr.	0.021	0.032	0.157	0.085	0.214	−0.113	0.203	0.126	0.085	0.083	0.204	0.227
8-impr.	−0.098	0.15	0.167	0.031	0.292	0.123	0.106	0.017	0.016	0.359***	−0.04	−0.025
9-impr.	−0.119	0.257	0.153	−0.012	0.188	−0.017	0.129	0.092	0.174	0.386***	0.053	0.099
10-impr.	0.091	0.135	0.233	0.06	0.336	0.17	0.159	0.084	0.114	0.347***	0.105	0.113
11-impr.	0.17	0.126	0.111	−0.008	0.193	−0.088	0.192	0.13	0.13	0.221	0.094	0.08
12-impr.	−0.005	0.092	0.353***	0.136	0.424***	0.138	−0.023	−0.057	0.033	0.279	0.043	0.072
13-impr.	0.107	0.154	0.149	−0.183	0.121	0.064	0.216	0.007	0.051	0.125	−0.025	−0.057
14-impr.	0.021	0.198	0.262	−0.051	0.197	0.011	0.248	0.106	0.074	0.196	0.067	0.069
15-impr.	−0.064	0.226	0.311	0.017	0.191	0.019	0.351***	0.093	0.18	0.278	0.031	0.066
16-impr.	−0.035	0.187	0.161	0.327	0.153	0.12	0.413***	0.124	0.252	0.314	0.047	−0.033
17-impr.	0.024	0.246	0.109	−0.076	0.429***	0.214	0.245	0.113	0.055	0.263	0.111	0.032
18-impr.	−0.023	0.252	0.015	0.005	0.227	0.23	0.295	0.124	0.074	0.315	0.094	−0.061
19-impr.	0.161	0.055	0.092	0.068	0.082	0.143	0.256	0.166	0.25	0.131	0.061	−0.06
20-impr.	0.13	0.088	0.169	0.149	0.22	−0.035	0.283	0.491***	0.375***	0.258	0.139	0.065
21-impr.	0.039	0.205	0.136	0.037	0.224	0.175	0.334	0.254	0.318	0.342	−0.009	0
22-impr.	0.105	0.151	0.211	0.05	0.212	0.154	0.234	0.158	0.219	0.498***	−0.076	−0.151
23-impr.	−0.121	0.218	0.083	0.011	0.288	0.078	0.172	0.041	0.001	0.09	0.473***	0.369***
24-impr.	0.015	0.204	0.109	−0.005	0.286	−0.012	0.116	0.117	0.049	0.101	0.414***	0.547***

Table A2.

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Per Hilletofth is a Professor of Industrial Management at the University of Gävle in Sweden and a Visiting Professor at the University West in Sweden. His research focuses on operations strategy, manufacturing location, supply chain design, new product development and demand and supply integration. He has editorial assignments in several international journals. Per Hilletofth is the corresponding author and can be contacted at: prof.p.hilletofth@gmail.com

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