SUPPLY CHAINS ARE AFFECTED BY DISRUPTIONS, BUT RESPONSES ARE APPARENTLY MOVING SLOWLY

Pssst... you can join the panel for free!

Read more here

DILF and researchers from the Department of Entrepreneurship and Relationship Management at SDU in Kolding conduct several mini surveys each year, which focuses on different supply chain management issues. Respondents to these mini surveys are voluntary senior managers from various Danish companies represented as the Danish Supply Chain Panel. This article presents the results of a mini survey dealing with supply chain resilience.

By Jan Stentoft, Professor at Department of Entrepreneurship and Relationship Management, University of Southern Denmark and Ole Stegmann Mikkelsen, Associate Professor at Department of Entrepreneurship and Relationship Management, University of Southern Denmark

DANSK RESUMÉ:

DILF og forskere fra SDU udfører hvert år en række mindre surveys, der bliver besvaret af Det Danske Supply Chain Panel, bestående af en række senior managers fra forskellige virksomheder rundt omkring i hele Danmark.

De forskellige surveys fokuserer hver især på forskellige problemstillinger inden for supply chain management, og denne artikel, skrevet af Jan Stentoft og Ole Stegmann Mikkelsen fra Syddansk universitet, tager udgangspunkt i supply chain resilience i en tid, hvor forstyrrelser i virksomheders forsynings- kæder langt fra er ualmindelige. Læs mere om panelets besvarelser samt de spændende resultater i denne artikel.

/Redaktionen

1. Introduction

The last three years have provided a great deal of awareness about supply chain management for private and public enterprises as well as for citizens. The Covid-19 pandemic paralyzed global supply chains through lockdown of boarders, harbors and airports, and hereby hindered the exchange of raw materials, components and finished goods. Lockdowns took place to hinder the spread of the pandemic and leave due to illness caused by the pandemic. We have seen panic buys of raw materials, semi-manufactured goods and finished goods, which have skyrocketed the price levels. Likewise, transportation costs increased dramatically during the Covid-19 pandemic.

Furthermore, we have also witnessed the Suez Canal being blocked by the Taiwanese container vessel *Ever Given* due to a grounding. The canal was blocked for six days, leading to queues of more than 300 container ships, which resulted in massive delays with the cargo. It was close to being the 'perfect' storm when Russian troops invaded Ukraine, which hindered raw material, grain and other goods from being exported from Ukraine, and simultaneously hindered most Western companies to do business in Russia and

with Russian companies. The dependency on, for example, Russian oil and gas, became very visible, which has, on the other hand, brought forth some positive actions in terms of speeding up the green transformation. Additionally, the supply chains have also been affected by climate change. An example is the drought in Europe this summer, which had severe consequences for the maritime traffic at Rhine River, as it challenged transport of coal and petrol at flood barges. Also, geopolitical issues resulted in disturbances in the global supply chains. For example was the supply of microchips from Taiwan affected by the conflict between USA and China, concerning Taiwan's continued independency from China.

The above-mentioned examples of disruptions have made it more challenging, but also imore interesting, to work with the management of supply chains. However, the disruptions differ with respect to their degree of predictability. Sheffi (2015, p. 44) terms this "detectability lead-time", which is defined as "the time between knowing that a disruptive event will take place and the first impact." Some disturbances have long trends, and thus a positive detectability lead-time, in which companies have time

to prepare for the disturbances such as climate changes and increased energy consumption due to growth of the world population. Other events occur with little or no warning and thus have a neutral detectability lead-time. Examples hereof are an explosion in a factory, natural disasters or cyberattacks.

Finally, some disruptions are hidden and are only discovered some time after their occurrence such as food contamination and recalls of vehicles due to problems with their braking systems. To cope with the various supply chain disruptions, companies must build resilience into their supply chains. According to Christopher and Peck (2004), Supply Chain Resilience (SCRES) is "the ability of a system to return to its original state or move to a new, more desirable state after being disturbed". The aim is built resistance toward disruptions and thus minimizing the disruption severity (Sheffi, 2005). In this article, we report on how the Danish Supply Chain Panel are focusing and practicing SCRES.

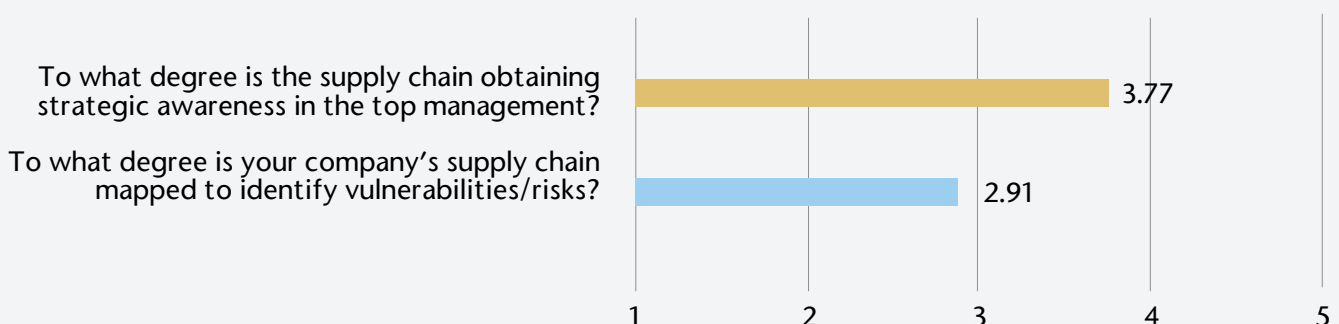## 2. Current supply chain resilience focus

It is of interest to investigate to what degree the panel members' companies' supply chains are obtaining strategic awareness among their top management. Furthermore, it is of interest if the companies have mapped their supply chains to identify potential vulnerabilities and risks. The answer appears in Figure 1.

In surveys like this, markings above 3.50 are perceived as significant. Hence, as seen in Figure 1, the Danish Supply Chain Panel reports that the supply chains are obtaining strategic awareness in top management, leaning toward a high degree with 3.77 on a five-point Likert scale, going from 1 (to a very low degree) to 5 (to a very high degree). However, as likewise depicted in Figure 1, the company's supply chain is only to some degree (2.91) mapped to identify vulnerabilities and risks. Thus, there seems to be a lack of execution from the strategic awareness of the supply chain to the actual degree of implementation of strategic activities in the companies.
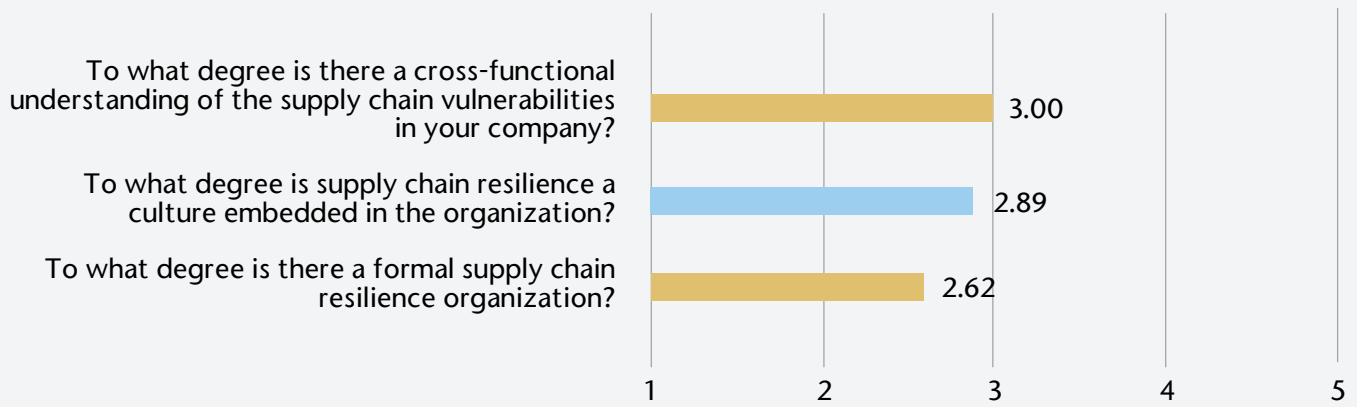
This lack is echoed in a previous survey from the Danish Supply Chain Panel (Stentoft & Mikkelsen, 2020). In this survey it was found that the relevance of mapping the supply chain, to identify potential risk, was of high perceived relevance (4.35) to the respondents, while mapping was 'only' to some degree (3.39) the actual practice. Furthermore, this was also identified in a survey from which the relevance of mapping obtained an average of 3.50 and actual level obtained an average of 3.05 (Stentoft & Mikkelsen, 2021a).

Another interesting avenue to investigate is to what degree the companies of the Danish Supply Chain Panel have been able to anchor SCRES as part of their organizational culture. Figure 2 contains the questions asked and their results.
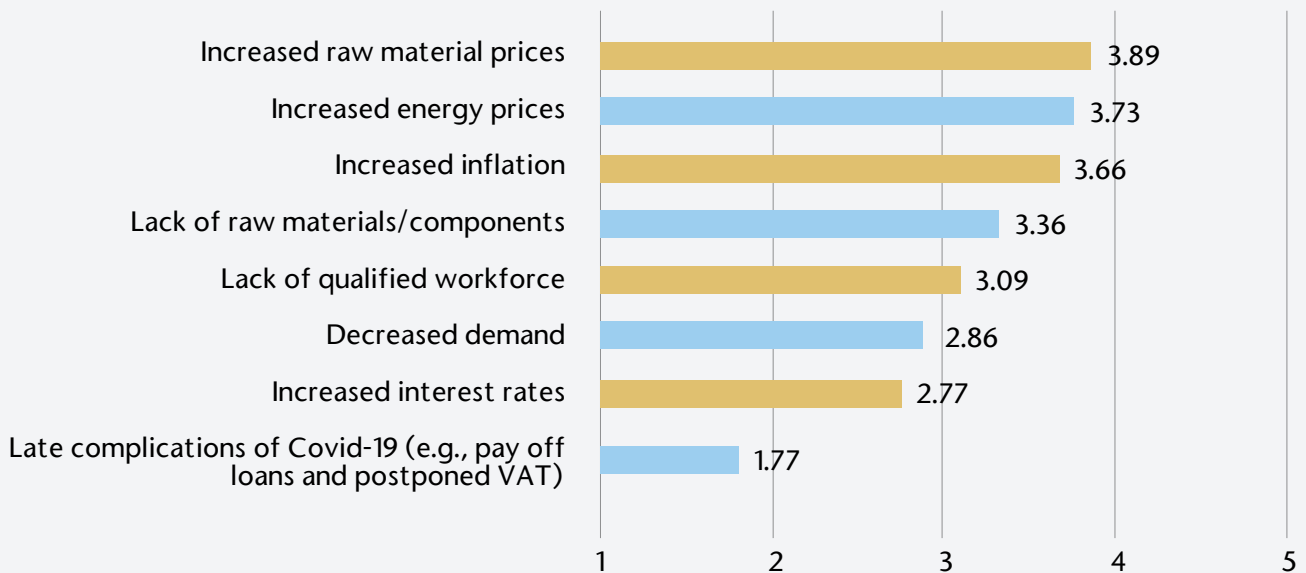
FIGURE 1. Top management awareness of supply chain management and supply chain mapping

FIGURE 2. Organizational issues

To what degree is there a cross-functional understanding of the supply chain vulnerabilities in your company?	3.00
To what degree is supply chain resilience a culture embedded in the organization?	2.89
To what degree is there a formal supply chain resilience organization?	2.62

Scale: 1 2 3 4 5

FIGURE 3. Factors affecting competitive advantage

Increased raw material prices	3.89
Increased energy prices	3.73
Increased inflation	3.66
Lack of raw materials/components	3.36
Lack of qualified workforce	3.09
Decreased demand	2.86
Increased interest rates	2.77
Late complications of Covid-19 (e.g., pay off loans and postponed VAT)	1.77

Scale: 1 2 3 4 5

As seen in Figure 2, the companies perceive that cross-functional understanding of the supply chain vulnerabilities is only present to some degree (3.00 on a five-point Likert scale). Likewise, although at a slightly lower level, we see that the companies, to some degree (with an average of 2.89), are reporting that SCRES culture is embedded in the organization. Even lower (with an average of 2.62), the companies report having a formal SCRES organization. Compared to the average of 3.77 in Figure 1, on the strategic awareness from top management on supply chain issues, there seems to be a significant gap, indicating a lack of execution skills in terms of drilling down the top management awareness of daily operations.

3. Factors challenging the competitive advantage

In the last three years, we have witnessed severe supply chain disruptions, which have significantly impacted the competitive power of the companies. In this vein, we find it of interest to understand which challenges that have affected the

companies competitive advantages the most. In Figure 3, the answers provided by the companies are shown on a five-point Likert scale.

It appears from Figure 3 that especially increased material prices are challenging the competitive power of the companies. With an average of 3.89 on the five-point Likert scale, companies perceive increased prices on materials to challenge the competitiveness of the companies close to a high degree. This is followed by increased energy prices, with an average of 3.73, and increased inflation, with an average of 3.66. Even though we have heard much about the lack of materials and components in the daily press, the respondents from the Danish Supply Chain Panel 'only' perceive this to have challenged the competitive position to some degree (3.36) on the five-point scale. One explanation for this may be, that the companies struggle to get their hands on materials and components from suppliers at the right amount and at the right time. However, as we have often heard during our meetings with companies, in the research project mentioned in the fact box, companies mention that they are not alone in lacking the right amount at the right time. It challenges all companies, including their competitors. Hence, the relative competitiveness may only be challenged to some degree.

Another interesting finding in Figure 3 is that a lack of qualified workforce is 'only' challenging the companies to some degree (with an average of 3.09). One would expect this to be higher, as we, in the news, often hear about that companies losing orders due to lack of human resources. At the same time, we witness a strong political pressure to open Denmark for more foreign workforce. Decreased demand and increased interest rates challenge the competitiveness to just below 'some degree', with averages of 2.86 and 2.77 respectively. At the bottom of the list of challenges, we find late complications of Covid-19 (e.g., payoff loans and postponed VAT), challenging competitiveness only to a low degree with an average of 1.77.

FACT BOX
Researchers from University of Southern Denmark in Kolding are currently working on a project with financial funds from the Danish Industry Foundation, that is concerned with improving supply chain resilience in small and medium-sized manufacturing enterprises.

A process model is developed, which demonstrates the importance of cross-functional participation in the evaluation of supply chain vulnerabilities and the required supply chain capabilities to handle the vulnerabilities. More information about the project can be found at: www.scr-smv.dk

4. Disruptions affecting the supply chains

Given the many challenges companies are facing due to the disruptions that have occurred within the last three years, we find it interesting to investigate which disruptions the respondents perceive to have affected the supply chains the most. The answers to this question are shown in Figure 4.

As it appears from Figure 4, the companies have a clear top three when it comes to disruptions affecting the supply chains: wars (with an average of 3.67), pandemics (with an average of 3.58) and price fluctuations with (with an average of 3.56). This is not surprising, as the war in Ukraine is very much on top of the agenda. The Covid-19 pandemic has created significant disturbances, and price increase is the top challenger of competitiveness (see Figure 4). Again, lack of workforce affects the supply chain to some degree (with an average of 3.14) as do geopolitical instability (with an average of 3.14). Likewise, man-made

FIGURE 4. Disruptions affecting the supply chains
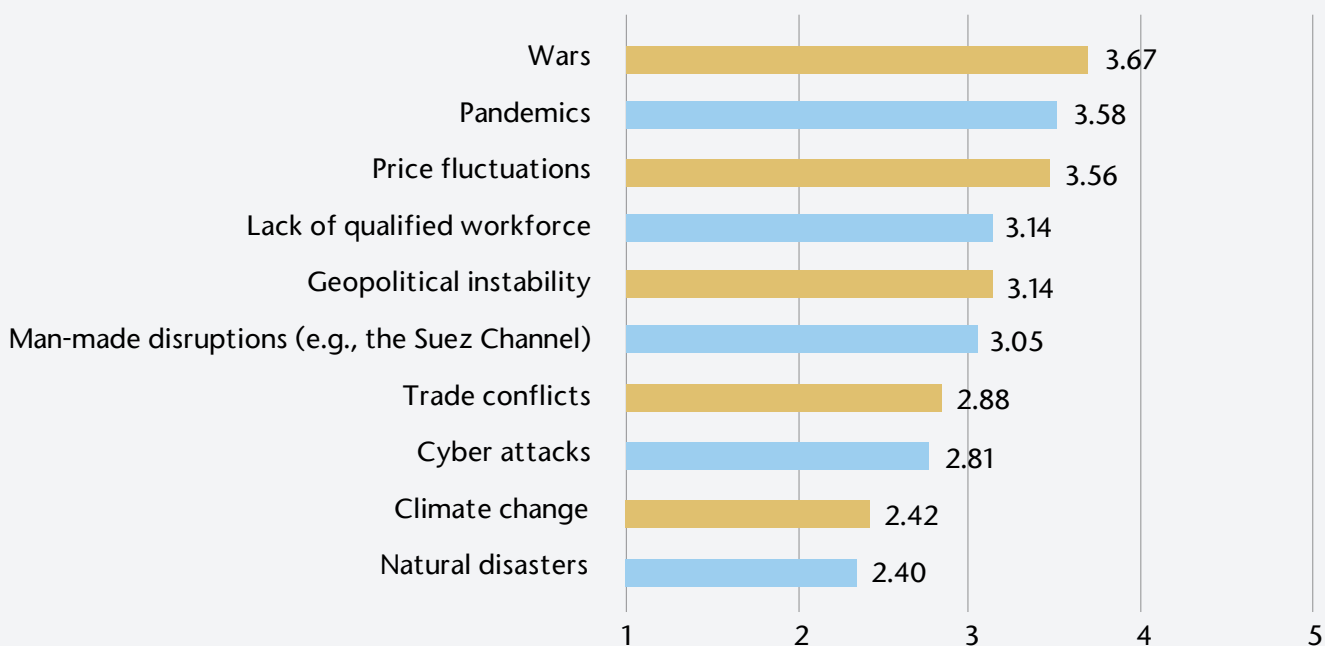
disruptions (average of 3.05) and trade conflicts (average of 2.88) are 'only' to some degree affecting the supply chains. Cyberattacks 'only' to some degree affect the supply chains (with an average of 2.81). This is interesting as the exposure to cyberattacks, and the following potential damages, are currently very much present in various media. It is important to notice that these types of disruptions are dynamic in nature, where some presently high ranked disruptions may rank lower ranked within the next half or one year.

Climate changes (with an average of 2.42) and natural disasters (with an average of 2.40) are not perceived as affecting the supply chains to a great degree.

5. Barriers for developing resilient supply chains

We are also interested in outlining which barriers the panel members are perceiving when working with SCRES. As it appears from Figure 5, it is especially the lack of time that the companies see as a barrier for working with SCRES, with an average of 3.26 on a five-point Likert scale (1 = to a very low degree, 5 = to a very high degree).
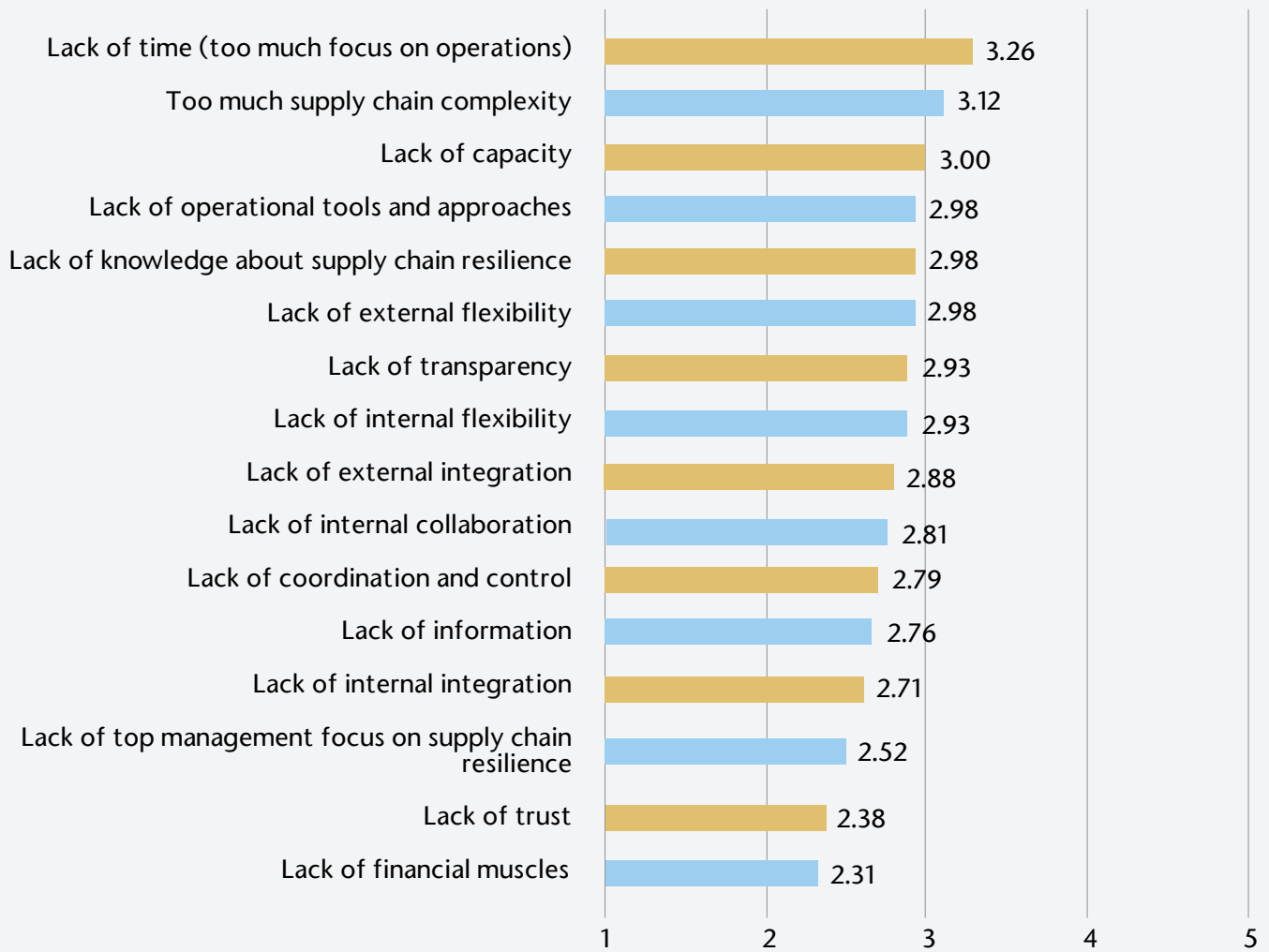
This is somewhat lower than the results in a survey from 2021 (Stentoft & Mikkelsen, 2021b), in which it was also found that the lack of time was among the top barriers, but with an average of 3.60. The second highest average of the listed barriers is "too much supply chain complexity", with an average of 3.12. This result is close to the average of 3.03 in the survey by Stentoft & Mikkelsen (2021b). The same is true for "lack of capacity", which in the present survey obtains an average of 3.00 and an average of 3.06 in the 2021 survey.

6. Specific supply chain resilience practices

The panel members have additionally been asked questions regarding the specific practices pursuing SCRES. The answers to these are shown in Figure 6.

Especially focus and efforts toward closer collaboration with key/strategic suppliers seem to stand out. When facing the recent disruptions, the panel companies have to a high degree (with an average of 3.86) increased their effort toward closer collaboration with key/strategic suppliers.

FIGURE 5. Barriers for supply chain resilience

Barrier	Value
Lack of time (too much focus on operations)	3.26
Too much supply chain complexity	3.12
Lack of capacity	3.00
Lack of operational tools and approaches	2.98
Lack of knowledge about supply chain resilience	2.98
Lack of external flexibility	2.98
Lack of transparency	2.93
Lack of internal flexibility	2.93
Lack of external integration	2.88
Lack of internal collaboration	2.81
Lack of coordination and control	2.79
Lack of information	2.76
Lack of internal integration	2.71
Lack of top management focus on supply chain resilience	2.52
Lack of trust	2.38
Lack of financial muscles	2.31

FIGURE 6. Current supply chain resilience practices

Practice	Value
Recent supply chain disruptions have increased our efforts with closer collaboration with key/strategic suppliers	3.86
We increase the level of safety stocks	3.26
We search for alternative materials (substitutes)	3.19
We are pursuing more local sourcing	3.02
We have two or more suppliers of critical materials/components/services	2.95
We have recovery plans in case of supply chain disruptions	2.90
We operate with supply chain contingency plans	2.69
We are applying supply chain risk tools	2.45
We are applying a supply chain control tower	2.24

When demand and supply uncertainty increases, a typical practice is to increase safety stock levels. This is also to some degree (with an average of 3.26) a practice undertaken in the companies as a SCRES practice to mitigate the uncertainties. This will, ceteris paribus, tie up more capital in inventories. However, from our studies of SCRES practice, we experience that the CFOs currently seem to be more patient on this subject.

Figure 6 also shows that the search for alternative materials/substitutes to some degree (with an average of 3.19) has been used as a SCRES practice. On the other hand, such a practice may also divert resources from R&D projects to engineering projects concerned with finding, testing, documenting, etc. the new materials or substitutes. Next follows the pursuit of more local sourcing (with an average of 3.02), a focus on two or more suppliers for critical materials/components/services (with an average of 2.95) and developing recovery plans in case of disruption (with an average of 2.90). To a lesser degree, companies apply supply chain risk tools (with an average of 2.45) and supply chain control towers (with an average of 2.24).
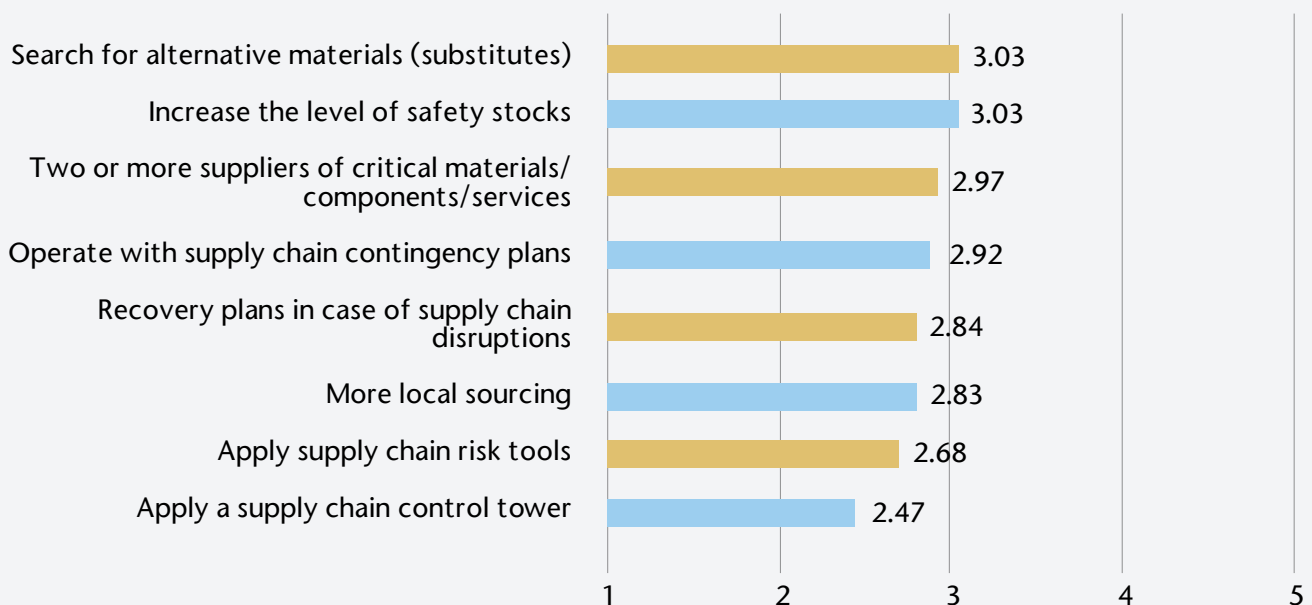
7. New practices to be implemented

After having investigated what the current practices are, we are interested in studying which future SCRES practices are to be implemented. The answers are visualized in Figure 7. First, we find it interesting that all the SCRES practices are planned to be adopted to only some degree (with averages of 3.00) or below. Given the last years turbulence, one would expect the supply chain practices to be planned to be adopted to a higher degree.

There are only minor changes in the numbers ranked in Figure 7 compared with the ranking in Figure 6. However, the numbers in Figure 7 may reflect that many of the SCRES practices are already adopted to some degree (see Figure 6). This is supported by the comments provided by some respondents (see Table 1).

8. Conclusion

This paper is makes a brief check-in with the practice of SCRES among the members of the Danish Supply Chain Panel. Data reveals that there is a strategic awareness of supply chains, but there seems to be a lack of focus on mapping the sup-

FIGURE 7. Planned supply chain resilience practices

Practice	Average
Search for alternative materials (substitutes)	3.03
Increase the level of safety stocks	3.03
Two or more suppliers of critical materials/components/services	2.97
Operate with supply chain contingency plans	2.92
Recovery plans in case of supply chain disruptions	2.84
More local sourcing	2.83
Apply supply chain risk tools	2.68
Apply a supply chain control tower	2.47

TABLE 1. Number of respondents commenting that they have already installed the practices

Supply chain resilience practices	Number of respondents
Recovery plans in case of supply chain disruptions	3
Two or more suppliers of critical materials/components/services	3
Increase the level of safety stocks	3
Apply a supply chain control tower	3
Operate with supply chain contingency plans	2
Search for alternative materials (substitutes)	1
Apply supply chain risk tools	1

ply chain in regards to identifying vulnerabilities and risks. Data also reveal a lack of cross-functional focus on SCRES and little focus on SCRES culture and organization. The top three factors that have challenged the competitive power of the companies are increased prices on materials, increased energy prices and increased inflation.

The top three disruptions that have affected the supply chains are wars, pandemics and price fluctuations. Regarding perceived barriers to working with SCRES, they do not score high averages i.e., they only appear to "some degree" or "to a low degree". The top three barriers are lack of time, too much complexity and lack of capacity. The panel members report that they practice closer collaboration with strategic suppliers, increasing their safety stock levels and searching for alternative materials as current SCRES initiatives.

These are also key areas for continued focus, although the averages, surprisingly, only reach a "to some degree" level. We hope the paper can kickstart discussions on the current and the desired levels of SCRES to assure competitiveness./

REFERENCES
Christopher, M. & Peck, H. (2004), "Building resilient supply chain", *The International Journal of Logistics Management*, Vol.15 No. 2, pp. 1-13.

Den sikkerhedspolitiske analysegruppe (2022), *Dansk sikkerhed og forsvar frem mod 2035*, Udenrigsministeriet, København K.

Sheffi, Y. (2005), *The Resilient Enterprise: Overcoming Vulnerability for Competitive Advantage*, MIT Press, London.

Sheffi, Y. (2015), *The Power of Resilience: How the Best Companies Manage the Unexpected*, The MIT Press, London.

Stentoft, J. & Mikkelsen, O.S. (2021a), "An absence of procurement risk management", *DILFaktuelt*, February, no. 10, pp. 28-34.

Stentoft, J. & Mikkelsen, O.S. (2021b), Supply Chain Resilience i praksis: Resultater af en spørgeskemaundersøgelse blandt produktions- og logistik- og transportvirksomheder i Region Syddanmark, Institut for Entreprenørskab og Relationsledelse, Syddansk Universitet.

Stentoft, J. & Mikkelsen, O.S. (2020), "The COVID-19 pandemic has increased the awareness of supply chain resilience, but recovery plans are still absent", *DILFaktuelt*, August, no. 7, pp. 46-54.