MANAGING SUPPLY CHAIN DISRUPTIONS

The coronavirus crisis

SURVEY FINDINGS

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INTRODUCTION

Supply chains are inherently susceptible to disruptions that can affect their operations at various scales. Some disruptions are predictable, and companies can build risk management strategies to predict, assess and mitigate them. Unpredictable disruptions, however, are harder to prepare for. Thus, they can become a true test of supply chains' robustness to shocks. The outbreak of the coronavirus pandemic at the beginning of 2020 was such an unpredictable disruption that tested the robustness of different supply chains all over the world.

The present survey investigated what impact the coronavirus-crisis had on different types of firms in different industries, how managers dealt with the disruptions, and what they plan to do to protect their supply chains going forward.

The findings show that **77% of firms had been impacted by the pandemic to a certain degree**, and that the **number/frequency of disruptions increased on average by 80% in 2020 compared to 2019.** However **only 21% of companies reported to having been impacted to a large or very large extent**. The most impacted area of the supply chain was *operations efficiency*, while *quality of products/services* saw the lowest impact.

In response to the Covid-19 event, **most companies look outside their firm for reducing the impact of future disruptions**, planning to increase both collaboration with and control over their supply chain partners. Of the internal protection mechanisms available, **increasing capacity and inventory and engaging in more dual- and multiple-sourcing are the most sought after**.

Results show that **companies that had higher supply chain visibility showed higher resilience to the disruption,** and a **lower impact from the Covid-19 event**.

The report shows the findings at an aggregate level, containing both US and Danish companies, given that the results are similar for both countries in most categories. Significant differences between the countries can be found in *Section 7*.

METHODOLOGY

In this report, we present the findings from a survey on managing the coronavirus-caused supply chain disruptions covering responses from +210 supply chain practitioners in Denmark and the US. The survey was conducted by Copenhagen Business School, and supported by IDA Operations Management and Supply Chain Leaders Forum (SCLF).

We investigated a model covering three main areas: antecedents to resilience and impact; the impact of the CoVid-19 pandemic; and learnings from the disruptions or planned changes[i].

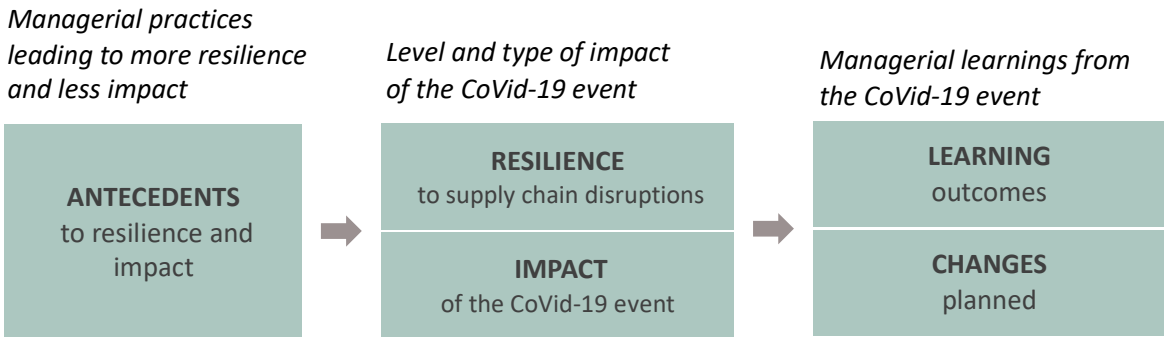

Figure 1 – Model investigated

In the *Antecedents* section, managers were asked to indicate the extent to which they agree to various statements regarding their company's approach to building up resilience competencies. Answers could be chosen from a 5-step scale ranging from "*Strongly disagree"* to "*Strongly agree."*

In the *Resilience/Impact* section, we asked managers to evaluate the extent to which different supply chain areas were impacted by the CoVid-19 pandemic. In the *Learnings/Planned changes* section, we asked managers to indicate to what extent their business unit pursued or made plans to pursue different activities since the Covid-19 disruption. For these two sections, managers could choose an answer from the a 5-step scale ranging from "*Not at all"* to "*To a very large extent."* See figures 2 and 3 below for an overview of the two scales.

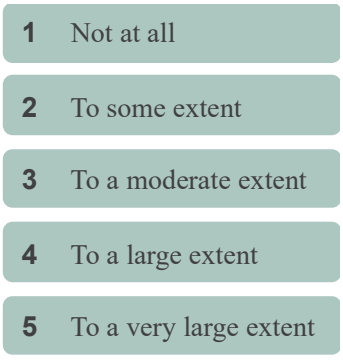

Figure 2 - 5-step scale for Impact *and* Learnings *sections*

Figure 3 - 5-step scale for Antecedents *section*

RESPONDENTS OVERVIEW

The sample was made up of **213 respondents** from the **United States** and **Denmark**, primarily working within **operations or manufacturing** (32%), **procurement** (19%). 73% of respondents have a management position, out of which 26 are **vice-presidents or above** (12%), 48 **are directors or vice-directors** (23%) and 59 are **managers or assistant managers** (28%).

COMPANY SIZE

The sample was almost equally distributed between medium-large and very large companies, with an underrepresentation of small firms: **89 corporations** (5.000 employees or more), **98 medium-large firms** (100 – 4,999 employees), **26 small firms** (under 100 employees)

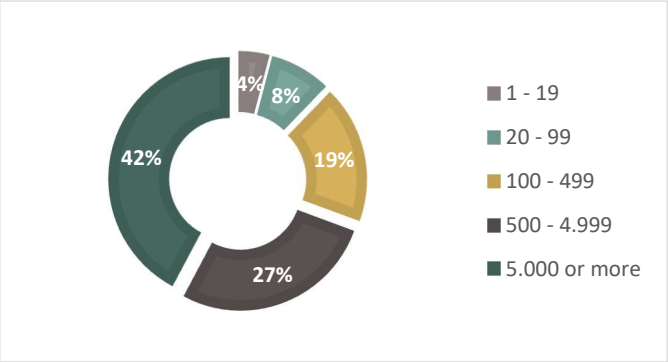

Figure 4 - Breakdown of respondents by company size

COMPANY AGE

Most of the firms investigated have been in business for **more than 50 years (102)**, followed by medium-old firms operating for **10-49 years (87),** and lastly young firms with **under 10 years** in business **(24)**.

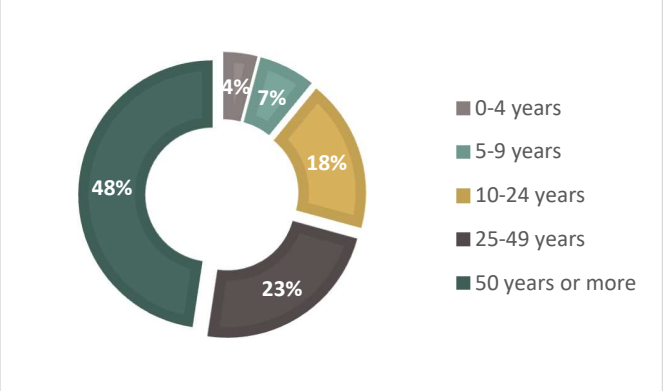

Figure 5 - Breakdown of respondents by company age

RESPONDENTS OVERVIEW

INDUSTRY

The sample was almost equally distributed between manufacturing companies (54%) and service companies (45%).

Industry	*Count*	%
Financial and insurance	*1*	0,5%
Mining and quarrying	*4*	2%
Construction	*6*	3%
Information and communication	*10*	5%
Transportation	*15*	7%
Whole and retail trade	*23*	11%
Other business services	*40*	19%
Manufacturing	*114*	54%
Grand Total	***213***	**100%**

Figure 6 - Breakdown of respondents by industry

MANUFACTURING SECTORS

The 114 manufacturing firms investigated break up into different sectors, the best represented of which were **machinery and equipment** (19), **electronic and optical products** (16), **chemical, plastics, metal, glass, concrete** (16)**,** and **food, beverages and tobacco** (15).

Manufacturing sector	*Count*	%
Wood and paper products	*1*	1%
Furniture	*2*	2%
Textiles and leather products	*2*	2%
Motor vehicles	*4*	4%
Energy (oil, gas)	*5*	4%
Pharmaceuticals	*8*	7%
Food products, beverages, tobacco	*15*	13%
Chemicals, plastic, metals, glass, concrete	*16*	14%
Electronic and optical products	*16*	14%
Machinery and equipment	*19*	17%
Other	*26*	23%
Grand Total	***114***	**100%**

Figure 7 - Breakdown of respondents by manufacturing sector

COVID-19 IMPACT ON SUPPLY CHAINS

We investigated the impact of the CoVid-19 pandemic on supply chains by analyzing to what extent the pandemic affected six main supply chain areas[ii]:

- Procurement costs
- Operations efficiency
- Quality of final products/services
- Responsiveness to demand
- Delivery reliability
- Sales

Figure 8 - Supply chain areas investigated for size of impact

Overall, **77% of firms had been impacted by the pandemic to a certain degree**. Most firms have been impacted, on average, to a low extent. **Only 21% of companies were impacted to a large or very large extent**.

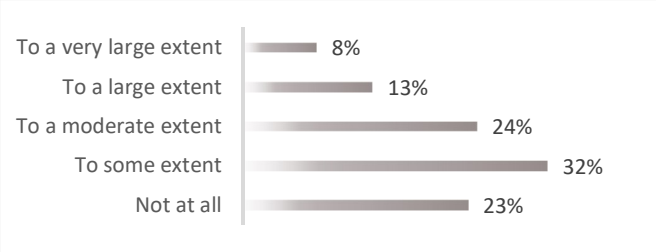

Figure 9 – Overall impact of CoVid-19 disruption

The highest impacted area was **operations efficiency: 90% of firms** were affected to a **certain degree**, with **26% affected to a large or very large extent**. The least impacted area was **quality of final products/services: 54%** saw **no effect**, while only **6%** were affected to **a large or very large extent**.

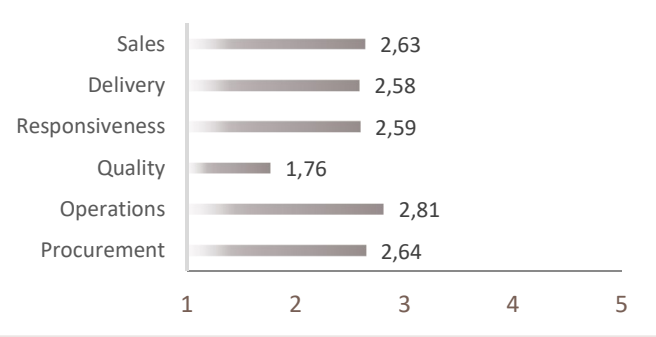

Figure 10 – Size of impact on different supply chain areas

*1-Not at all; 2-To a low degree; 3-To a moderate degree; 4-To a large degree; 5-To a very large degree

COVID-19 IMPACT ON SUPPLY CHAINS

The **largest effect on operations** was experienced by **very large companies** (5.000 employees or more). It is expected that larger firms have more complex operations, which are more difficult to adjust in times of need.

As expected, **very small companies** (with less than 20 employees) were more affected than larger companies on **procurement costs.** This effect might be caused by their lower bargaining power over their suppliers due to the lower volume of purchases. Suppliers that experienced a reduction in their operations and output were forced to prioritize customers whose orders they can honor.

AFFECTED INDUSTRIES

The level of impact was quite similar across industries, ranging between low and moderate across all areas investigated.

Industry	Average	*Count*
Whole and retail trade	2,7	*20*
Transportation	2,6*	*9*
Manufacturing	2,5	*86*
Other business services	2,4	*31*
Mining and quarrying	1,5*	*4*
Grand Total	**2,5**	*150*

Figure 11 – Disruption impact across industries

*High uncertainty of the average given the low count.

**1-Not at all; 2-To a low degree; 3-To a moderate degree; 4-To a large degree; 5-To a very large degree

AFFECTED MANUFACTURING SECTORS

Similarly to the overall trend, the manufacturing industry saw **the largest effect on operations efficiency**, and **the lowest on product quality**.

Within the industry, the most affected sector was the *food, beverage and tobacco* sector. The most affected supply chain area for the sector was **operations**, followed by **sales** and **delivery reliability.** All of these areas saw a **moderate to large impact**.

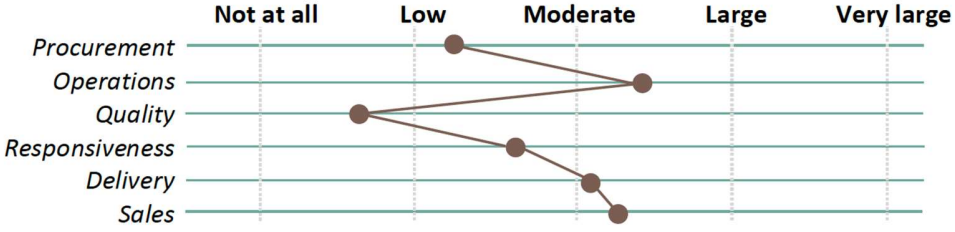

Figure 12 - Impact on food, beverage and tobacco manufacturers

IMPACT ON PROCUREMENT COSTS

The first area investigated was Procurement costs, or prices of purchased items. The findings of the survey would seem to indicate that **very small companies (under 20 employees) and very large companies (over 5.000 employees) saw the highest effects on procurement costs**. While it was expected to be so for very small companies, the result for very large companies is surprising. It would be expected that larger companies have higher bargaining power towards their suppliers and would thus be able to keep prices of their purchased items constant. However, one item that did increase in price for all, was air-transport.

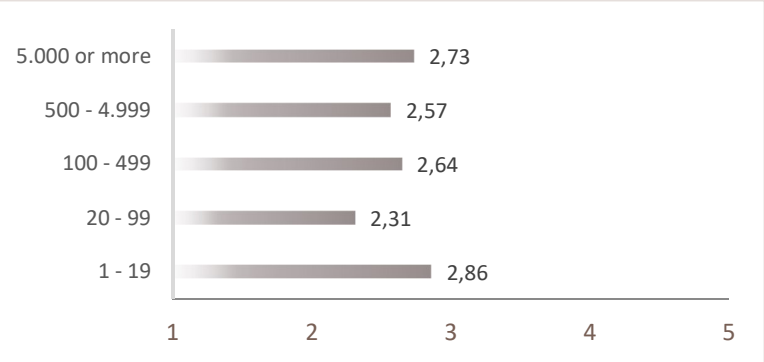

Figure 13 – Size of impact by company size

The most impacted industry on procurement costs was the *whole and retail industry*, with **75% of firms** experiencing a **moderate to high impact** on this area.

IMPACT ON MANUFACTURING SECTORS

Within the manufacturing industry, the highest effect on procurement was felt by the **machinery and equipment** sector. Overall, the entire manufacturing sector saw a low to moderate impact on procurement.

Manufacturing sector	Average	*Count*
Pharmaceuticals	2,86*	*7*
Machinery and equipment	2,80	*15*
Other (please specify)	2,76	*21*
Energy (oil, gas)	2,60*	*5*
Electronic and optical products	2,50	*12*
Chemicals, plastic, metals, glass, concrete	2,36	*11*
Food products, beverages, tobacco	2,25*	*8*
Motor vehicles	2,00*	*4*
Grand Total	**2,63**	***83***

Figure 14 – Size of Impact on procurement by manufacturing sector

*High uncertainty of the average given the low count.

**1-Not at all; 2-To a low degree; 3-To a moderate degree; 4-To a large degree; 5-To a very large degree

IMPACT ON OPERATIONS EFFICIENCY

The supply chain area most impacted overall was Operations efficiency. An interesting finding is that companies aged 10-24 years saw a much higher impact than the rest of firms. As this is the age of accelerated growth, it is possible that companies in this age bracket in general are less robust in their companies' resilience capabilities and that the Covid-19 event exposed vulnerabilities in their supply chain setup.

Row Labels	Average
0-4 years	2,00
5-9 years	2,73
10-24 years	3,24
25-49 years	2,58
50 years or more	2,81
Grand Total	**2,81**

Figure 15 - Size of impact on operations efficiency by company age

Moreover, the findings of the survey would seem to suggest that the larger a company is, the higher an impact it experiences on operations efficiency. This result is not surprising, as it is expected that the larger a company is, the more complex its operations become and the more difficult they are to adjust.

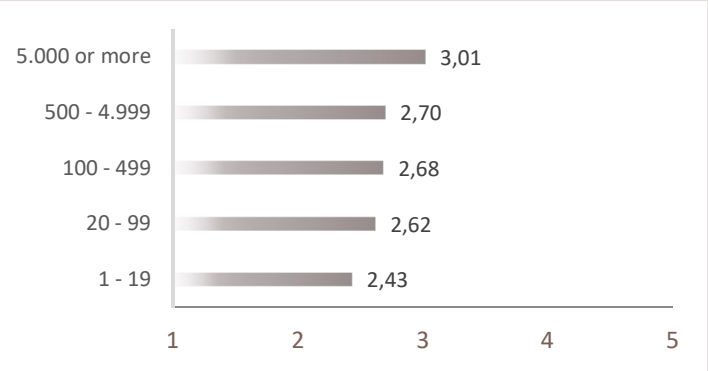

Figure 16 – Size of impact on operations efficiency by company size

Across industries, the findings suggest that *whole and retail trade* companies and *manufacturing companies* saw the highest impact (for an average of 2,9). This is probably a result of the nationwide lockdowns, and the shift towards e-commerce.

IMPACT ON SALES

Overall, the sales area was impacted to almost the same degree as the procurement area, averaging at 2,64. Similarly to procurement, the highest impact was experienced by companies which are either very small (under 20 employees) or very large (over 5.000 employees).

Similarly to the overall trend, *whole and retail companies* were the most affected on sales. What is interesting to note is that companies within this industry vary considerably regarding the effects on sales:

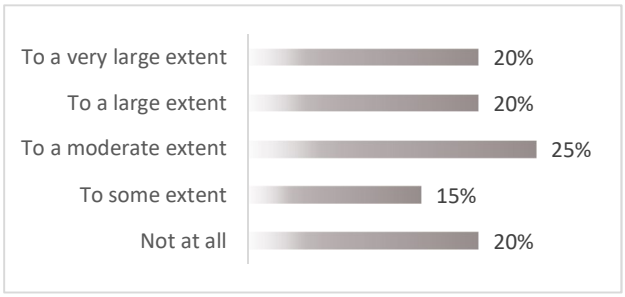

Figure 17 – Size of impact on sales for whole and retail companies

Within the manufacturing industry, the most impacted sector was the *food, beverages and tobacco* producers, averaging a moderate to high impact on sales. This impact was probably driven by the double effect on food, beverage and tobacco: higher sales towards private consumers as people started spending most of their time at home, on one side; and a significant drop in sales towards the hospitality industry (hotels, restaurants, catering) as an effect of government restrictions on the latter sector.

Manufacturing sector	**Average**	*Count*
Food products, beverages, tobacco	3,25*	*8*
Motor vehicles	3,00*	*4*
Other (please specify)	2,67	*21*
Chemicals, plastic, metals, glass, concrete	2,64	*11*
Electronic and optical products	2,58	*12*
Machinery and equipment	2,27	*15*
Energy (oil, gas)	2,20*	*5*
Pharmaceuticals	1,86*	*7*
Grand Total	**2,58**	*83*

Figure 18 – Size of impact on sales by manufacturing sector

*High uncertainty of the average given the low count.

**1-Not at all; 2-To a low degree; 3-To a moderate degree; 4-To a large degree; 5-To a very large degree

NUMBER OF DISRUPTIONS IN 2020

We also investigated the difference between the number of supply chain disruptions in 2020 (or the first year of the coronavirus-crisis) compared to 2019 (the year before the coronavirus-crisis).

For the purpose of the study, a ***supply disruption*** was defined as:
"*an event that materialized in the supply chain and that led to a situation that had the potential for severe negative consequence for the focal firm.*"

Our findings suggest that, on average, companies experienced **an increase of 80% in the number of disruptions** in 2020 compared to 2019. This demonstrates the significance of the coronavirus-crisis for supply chains.

The highest percentual increase was observed for *medium-large companies* (100-499 employees), which saw an increase of 128%. One potential explanation is that a large number of medium-large companies can be understood to be in a maturation phase, where some globalization and formalization have occurred, but robustness and experience is still lacking behind, making the firms more vulnerable. However, there might be other equally valid interpretations.

Company size (No. employees)	**% increase**
1 - 19	73%
20 - 99	52%
100 - 499	128%
500 – 4.999	83%
5.000 or more	69%
Grand Total	**79%**

Figure 19 – Percentage increase in the number of disruptions 2020 compared to 2019 by company size

Very large companies (5.000 employees or more) experienced the highest number of disruptions both in 2019 and 2020, but the percentual increase from 2019 to 2020 was the lowest of all firms (69%).

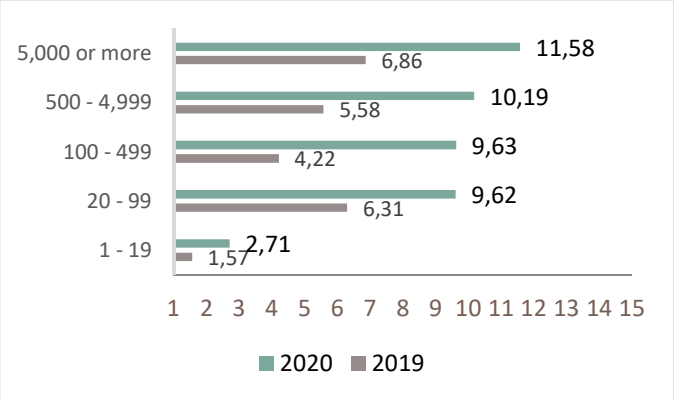

Figure 20 – Number of disruption in 2020 and 2019

Of all industries investigated, **whole and retail trade** experienced the most disruptions both in 2019 and 2020. Similarly to the trend observed for very large companies, the percentual increase in the number of disruptions was much lower than average. These findings seem to suggest that companies that have higher experience with disruptions were affected less by the coronavirus-crisis.

Industry	**2019**	**2020**	**% increase**	*Count of firms*
Information and communication*	3,33	9,17	175%	*6*
Manufacturing	5,89	11,32	92%	*84*
Mining and quarrying*	3,75	7,75	107%	*4*
Other business services	5,13	8,57	67%	*30*
Transportation*	4,89	6,44	32%	*9*
Whole and retail trade	8,11	12,11	49%	*18*
Grand Total	**5,76**	**10,29**	**79%**	*151*

Figure 21 – Average number of disruptions in 2019 and 2020 by industry
*High uncertainty on the averages given the low count

Within the manufacturing industry, the largest percentual increase in the number of disruptions was observed for the **electronic and optical products** and **food, beverages, tobacco** sectors.

Manufacturing sector	**2019**	**2020**	**% increase**	*Count of firms*
Chemicals, plastic, metals, glass, concrete	3,9	8,3	112%	*11*
Electronic and optical products	5,0	11,9	138%	*12*
Energy (oil, gas)*	7,6	13,4	76%	*5*
Food, beverages, tobacco*	5,5	12,6	130%	*8*
Machinery and equipment	7,0	12,1	73%	*15*
Motor vehicles*	4,0	10,5	163%	*4*
Other	8,3	13,9	68%	*19*
Pharmaceuticals*	2,9	6,4	125%	*7*
Grand Total	**5,9**	**11,3**	**92%**	*81*

Figure 22 – Average number of disruptions in 2019 and 2020 by manufacturing sector
*High uncertainty on the averages given the low count

WHAT WAS LEARNED?

Next, we investigated what companies learned from the coronavirus-caused disruptions, by asking managers whether they pursued or made plans to pursue different activities, pertaining to two resilience strategies: *buffering* and *bridging*[iii].

Buffering actions attempt to establish safeguards to protect a firm from disturbances, through *increasing capacity and inventory, moving towards a local supply chain set-up, using dual- or multiple sourcing* or *diversifying market offerings.*

Bridging actions attempt to manage uncertainty through *increasing collaboration with or control over supply chain partners*.

Overall, our findings suggest that companies, as response to the Covid-19 events, planned to engage more in bridging than in buffering, meaning that they prefer to strengthen the relationship with their supply chain partners over creating internal safeguards against disruptions. This trend was observed regardless of company size, age and industry.

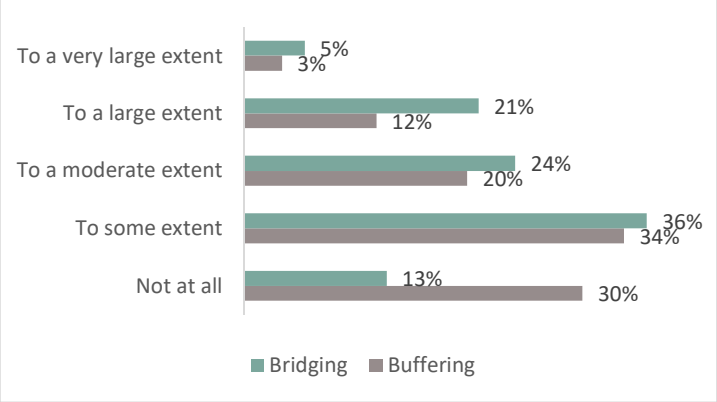

Figure 23 - Buffering and bridging as response strategies to the Covid-19 disruption

Within the manufacturing industry, machinery and equipment producers were the least inclined to protect their supply chain by using buffering activities.

Manufacturing sector	Buffering	Bridging	Count
Chemicals, plastic, metals, glass, concrete	2,2	2,5	*11*
Electronic and optical products	2,2	2,4	*11*
Energy (oil, gas)*	2,0	2,3	*5*
Food, beverages, tobacco*	2,0	2,6	*8*
Machinery and equipment	1,7	2,4	*14*
Motor vehicles*	1,7	2,7	*4*
Other	2,3	2,6	*19*
Pharmaceuticals*	2,2	3,2	*8*
Grand Total	**2,1**	**2,6**	*80*

Figure 24 - Average use of buffering and bridging activities by manufacturing sector

*High uncertainty given the low count.

CREATING BUFFERS

Four different types of activities were investigated regarding the buffering strategy: **increasing capacity and inventory, localizing the supply chain, reducing single-sourcing** and **diversifying market offerings.**

Figure 25 - Types of buffering activities investigated

Overall, **70%** of respondents said that they **engaged in some form of buffering**; however **only 15% use or planned to use buffering at a large or very large extent.**

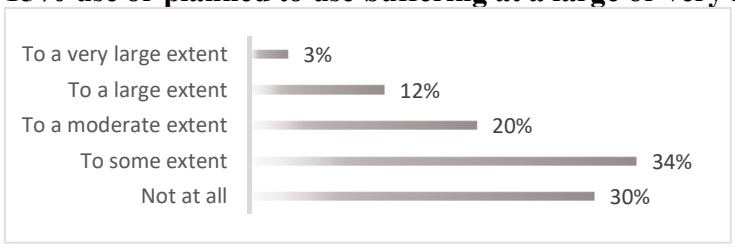

Figure 6 - Extent of the use of buffering activities

Of the four types of activities investigated, companies prefer *increasing capacity and inventory* and *engaging in more dual- and multiple-sourcing.* The least preferred activity is *localizing the supply chain.* The low preference for localization might be explained by high labour costs in the US and Europe and the lack of specialised suppliers in the area.

Buffering activity	Average
Capacity/inventory	2,49
Localizing the SC	1,96
Dual/multiple sourcing	2,43
Diversifying market offerings	2,07
Grand total	**2,20**

Figure 26 - Average per buffering activity

*1-Not at all; 2-To a low degree; 3-To a moderate degree; 4-To a large degree; 5-To a very large degree

BRIDGING CONNECTIONS

The second strategy to increasing resilience to disruptions is building bridges across the supply chain by engaging in either closer collaboration with or more control over key supply chain partners. The figure below show what types of activities might increase collaboration and what activities can increase control.

Figure 27 - Types of bridging activities investigated

On average, **88%** of respondents use or plan to use bridging activities (either collaboration or control) in response to the coronavirus-crisis. **24%** of managers consider increasing **control** to a **large or very large extent.** At the same time, **30%** consider increasing **collaboration** to a **large or very large extent.**

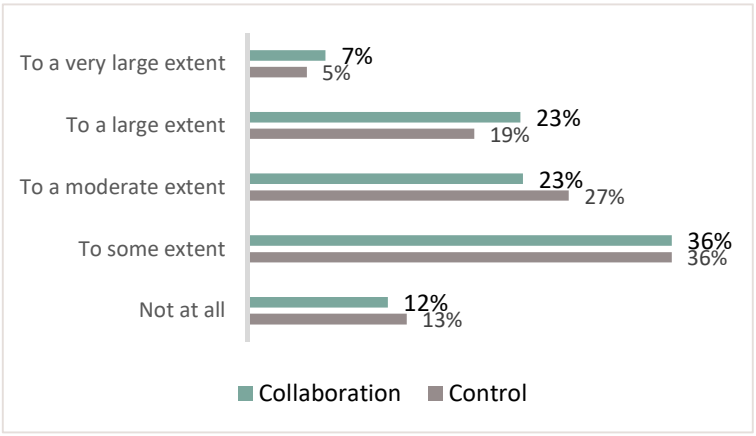

Figure 7 – Extent of the use of bridging activities

Overall, managers across company sizes, ages and industries tend to prefer using collaboration over control activities. One interesting exception is **manufacturers of food, beverages and tobacco**, which prefer to use **control** activities. In particular, they have a higher than average propensity to use **information systems** to manage supply chain risks and disruptions.

BRIDGING CONNECTIONS

The survey results seem to indicate that **pharmaceuticals manufacturers** tend to use both control and collaboration to a significantly larger extent than other manufacturing sectors.

Manufacturing sector	Control	Collaboration	*Count of firms*
Chemicals, plastic, metals, glass, concrete	2,52	2,45	*11*
Electronic and optical products	2,33	2,55	*11*
Energy (oil, gas)*	2,20	2,27	*5*
Food, beverages, tobacco*	2,63	2,54	*8*
Machinery and equipment	2,19	2,55	*14*
Motor vehicles*	2,56	3,00	*4*
Other	2,63	2,67	*19*
Pharmaceuticals*	3,19	3,24	*8*
Grand Total	**2,5**	**2,6**	*80*

Figure 29 - Average use of control vs. collaboration activities across manufacturing sectors
*High uncertainty given the low count.

COLLABORATION

Among collaboration activities, the **least preferred** overall is **engaging in risk management activities together with key supply chain partners.** This can be due to the reluctancy to reveal internal vulnerabilities to supply chain partners and/or the costs associated with coordination.

Collaboration activity	Average
Establish closer relationships	2,80
Improve information exchange	2,90
Engage in more risk management activities with partners	2,61
Grand Total	**2,80**

Figure 30 - Average use of collaboration activities

CONTROL

Among control activities, the **least preferred** is the **use of information systems for managing risks and disruptions**. Overall, our findings suggest that the use of IT analytics is the least preferred resilience strategy, reflecting the overall **low digital maturity of the supply chain function**.

Control activity	Average
Increase visibility	2,80
Increase evaluation and control	2,78
Use more risk management information systems	2,42
Grand Total	**2,70**

Figure 31 – Average use of control activities

ANTECEDENTS TO RESILIENCE

We also investigated how companies had prepared to make their organizations, processes and supply chains more resilient to disruptions. Specifically we explored the following variables and management practices[iv]:

Risk Management Orientation	The extent to which risk management is understood as important and embedded in the organisational culture.
Risk Management Organization	The extent to which a dedicated risk management organization is in place (i.e. dedicated departments, people).
Risk Management Procedures	The extent to which risk management procedures are used (i.e. risk identification, prioritization, monitoring, contingency plans, preparedness exercises).
Risk Management Information Systems	The extent to which Information Systems are used to identify and analyse supply chain risk.
Supply Chain Visibility	The extent to which activities in the supply chain are visible to the company.
Supply Chain Connectivity	The extent to which the supply chain processes are globalized and interrelated.

Figure 32 - Antecedents to resilience investigated

In general the companies that responded to our survey reported some degree of preparation to supply chain disruptions (overall average for antecedents was 3,5). The highest score was given to risk management orientation and supply chain connectivity (with an average of 3,9 corresponding to *Somewhat agree*). Three of the variables (risk management organization, procedures and supply chain visibility) averaged at 3,4 - between *Neither agree nor disagree* and *Somewhat agree*. The lowest score was given to Information systems, revealing a low degree of digitalization of risk management processes in supply chains (an average of 2,9 corresponding to *Neither agree nor disagree* on the scale).

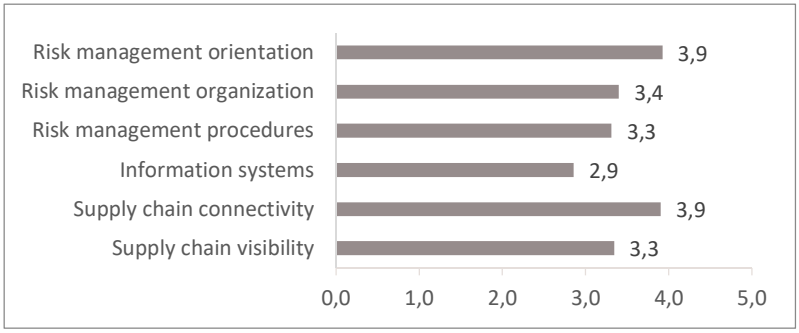

Figure 33 - Average of antecedents investigated

*1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly agree

ANTECECEDENTS TO RESILIENCE

The findings suggest that **companies perceive themselves as having sufficient risk management orientation** (averaging around *Somewhat Agree*); however, **when asked about specific risk management capabilities**, such as risk management departments, people, procedures, information systems or supply chain visibility, **the averages drop** towards *neither agree nor disagree.* This suggests the need for more dedicated efforts towards and investments in risk management and preparation for disruptions.

WHAT TO FOCUS ON?

We found strong statistically significant direct relationships between the below list of variables and resilience, and as more resilient organizations experienced less impact from the Corona-crisis, theses variables were also found to be of significance for firms to avoid the disruptions that were caused by the Covid-19 events.

The list below is arranged in descending order, with the strongest relationships first. Thus, we found "supply chain visibility" to have the strongest impact on resilience.

1. *Supply chain visibility*
2. *Risk management orientation*
3. *Risk management procedures*
4. *Risk management information systems*
5. *Risk management organization*

Concerning **connectivity**, we found that the positive effect of supply chain visibility on resilience was reduced by the levels to which the firms had a globalized and inter-connected supply chain. Although interesting, this is maybe not that surprising, as firms with higher levels of supply chain connectivity are faced with more complex and thus more vulnerable supply chains.

HOW DO DANISH AND AMERICAN FIRMS DIFFER?

Danish and American companies consider themselves **equally resilient and evaluate the impact of the Covid-19 pandemic on their supply chains to the same level**. However, **American companies seem to have more risk management orientation**, including dedicated departments, practices and information systems. The difference is particularly significant for risk management information systems and specifically the use of big data analytics and/or artificial intelligence.

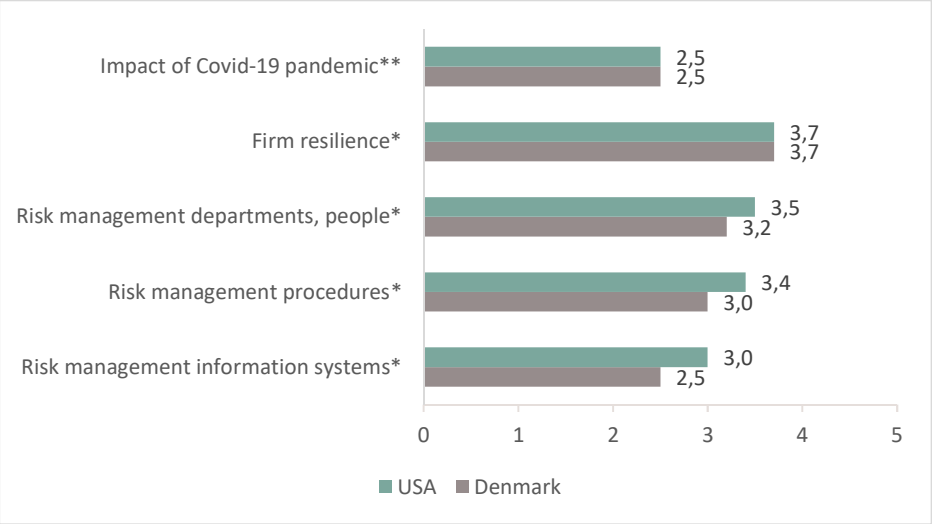

Figure 34 – Average resilience, impact and antecedents for American vs. Danish companies
*1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly agree
**1-Not at all; 2-To a low degree; 3-To a moderate degree; 4-To a large degree; 5-To a very large degree

Although overall the impact of the Covid-19 disruption is evaluated to the same level, American firms saw a much higher impact on sales than Danish firms.

Supply chain area	Denmark	US
Procurement	2,60	2,66
Operations efficiency	2,86	2,78
Quality of products/services	1,88	1,71
Responsiveness to demand	2,56	2,60
Delivery reliability	2,60	2,58
Sales	2,26	2,80
Overall	**2,50**	**2,50**

Figure 35 – Average impact on different supply chain areas by country
*1-Not at all; 2-To a low degree; 3-To a moderate degree; 4-To a large degree; 5-To a very large degree

HOW DO DANISH AND AMERICAN FIRMS DIFFER?

The findings also show that both countries had an increase **of the number of disruptions from 2019 to 2020 of more than 75%**, revealing a significant impact of the CoVid-19 events. Denmark seems to have experienced a higher percentual increase in the number of disruptions from 2019 to 2020, although American companies had a higher number of disruptions than Danish companies both in 2019 and 2020.

	2019	2020	% increase
Denmark	4,02	7,47	86%
US	6,57	11,59	77%
Grand Total	**5,76**	**10,29**	**79%**

Figure 36 - Average number of disruptions in 2019 and 2020 by country

RECOMMENDATIONS FOR MANAGEMENT

UNDERSTANDING THE IMPACT POTENTIAL

Our findings demonstrate the significance of the impact of the Coronavirus-crisis on supply chains. 77% of firms had been impacted by the pandemic to a certain degree, and the number/frequency of disruptions was reported to have increased on average 80% in 2020 as compared to 2019.

However, our findings also tell a story about how these numbers hide a significant and complex diversity. The impact was highly diverse and our findings show how the impact depended on firm age, firm size, industry and the specific resilience competencies embedded in the organizations and work practices of the individual firms.

This highlights the importance of understanding the specific situation and environment in which the firm and its specific managerial practices are embedded. Thus, we urge managers, as part of building up more resilience competencies, to understand even better how the context of the firm or the department in itself makes is more or less vulnerable to future disruptions.

BUILDING UP MORE RESILIENCE

Our findings identified five important antecedents to firm resilience: Supply chain visibility; risk management orientation; risk management procedures; risk management information systems and risk management organization. As all reported statistical significance to firm resilience and thus to the firm's ability to manage future supply chain disruptions, we urge managers to consider their current performance in relation to these practices. If prioritization is needed, then supply chain visibility is a good place to start, as our results showed that this variable reported the strongest impact on firm resilience.

BUFFERING OR BRIDGING – THINK CAREFULLY ABOUT THE CONSEQUENCES

Our findings explored how firms learned and planned to change their supply chain practices. We found that most companies look outside their firm for reducing the impact of future disruptions, planning to increase both collaboration with and control over their supply chain partners. Of the internal protection mechanisms available, increasing capacity and inventory and engaging in more dual- and multiple-sourcing are the most sought after.

We recommend managers to think carefully about their reactions to the Coronavirus-event. While building up more buffers, or building in more supply chain controls might improve specific resilience capabilities, such reactions will also most likely decrease supply chain responsiveness and increase supply chain costs. Managers might find the typology of reactions used in this report useful in reflecting carefully about which reactions are the best matches for their individual supply chains. A thorough analysis of their supply chains is needed.

ENDNOTES

[i] The results reported in this report are to some extent affected by the low amount of responses on some of the reported and measured dimensions. This makes some of the conclusions less robust and statistically significant. Thus, care should be taken to make too solid and generalized conclusions based on these results. We thus urge more research in the area to complement, confirm or disprove our reported findings. We are also in the process of making additional academic analysis based on the collected data, and will report these in peer-reviewed academic outlets.

[ii] Following e.g. Bode, C., Wagner, S. M., Petersen, K. J., & Ellram, L. M. (2011). Understanding responses to supply chain disruptions: Insights from information processing and resource dependence perspectives. *Academy of Management Journal*, *54*(4), 833–856. https://doi.org/10.5465/AMJ.2011.64870145

[iii] Following e.g. Bode, C., Wagner, S. M., Petersen, K. J., & Ellram, L. M. (2011). Understanding responses to supply chain disruptions: Insights from information processing and resource dependence perspectives. *Academy of Management Journal*, *54*(4), 833–856. https://doi.org/10.5465/AMJ.2011.64870145

[iv] Following e.g. Ambulkar, S., Blackhurst, J., & Grawe, S. (2015). Firm's resilience to supply chain disruptions: Scale development and empirical examination. *Journal of Operations Management*, *33–34*, 111–122. https://doi.org/10.1016/j.jom.2014.11.002