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Responding to COVID19: The role of clusters in supply chain adjustments

European Cluster Collaboration Platform Discussion Paper 2

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November 2020

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European Commission

ECCP Discussion Papers

The European Cluster Collaboration Platform (ECCP) is the main hub facilitating cluster cooperation within the EU and beyond. It is supported by the European Commission through the COSME programme.

This Discussion Paper was submitted to the European Expert Group on Clusters on 22/09/20 as an input for their discussions on the role of clusters in building a more resilient supply chains in support of Europe's recovery from the COVID-19 pandemic.

The European Expert Group on Clusters provides the Commission, EU countries and regions with recommendations, advice, and expertise, specifically on how to better use clusters as a strategic tool of industrial policy, interregional collaboration and to integrate SMEs into EU and global value chains.

The members of the group are the EU countries and individual experts appointed in a personal capacity (selected via a call for applications).

1. Introduction

The COVID-19 pandemic has led to the disruption of global supply chains in which an important part of European industry is embedded. These disruptions pose the challenge of re-thinking supply chain management practices. Moreover, the revealed vulnerability of Europe's "industrial ecosystems"[1] has led to concerns about their (lack of) sovereignty and their dependence on external input providers, and to calls for a recovery of European supply chains.[2]

Exhibit 1: Reasons behind supply chain disruptions

Global supply chain disruptions manifest themselves in several forms and on headlines they can be due to "force majeure" causes or "opportunistic behaviour" on behalf of the supplier. Chiefly, these two categories can be divided as follows:

Force majeure	Opportunism
• Deliveries that did not come through as they were held up in ports or during transport legs <->	• Suppliers that retain shipments
• Providers that couldn't produce anymore as they run out of raw material (not shipped due to lack of input/activity in situ)	• Purveyors that ship deficient or inadequate material
• Suppliers that cease producing/shipping due to demand shortage from key clients: negative spill-over effects	• Providers that are selling to the highest bidder leaving other (potential) clients in the cold
• Purveyors that went bankrupt or were confined (furlough): lack of uniform interpretation of industry's systemic relevance	• Higher tier producers that attempt to bypass their direct clients to serve buyers further downstream in the chain

In this context several Member States have suggested reconsidering current approaches to international outsourcing of production, with a view to avoiding future supply bottlenecks while increasing resilience of national and European supply chains. For example, the French Minister of Economy and Finance has called for European governments to rethink their approach to supply chains to assure "sovereign" and "independent" supplies.[3] The latest plans to stabilize the German (industrial) economy also echo such ideas.[4] In addition, the private sector has voiced interest in rebuilding supply chains with a more pronounced European dimension.[5]

A common denominator behind governmental and business concerns regarding current disruptions is their wish to make supply chains more resilient and agile through enhanced security and flexibility.

[1] An industrial ecosystem is a network of specialised enterprises, often SMEs, and other related supporting actors that work together and connect their capabilities and clusters in a specific industrial supply chain that creates solutions to customers and consumers.

[2] Speech of Commissioner Breton at the European Parliament - Committee on Industry, Research and Energy, 24/4/2020.

[3] European industrial sovereignty. Minister Bruno Le Maire's speech - International press conference. 2 April 2020.

[4] www.bloomberg.com/news/features/2020-05-29/germany-s-merkel-is-seizing-chance-to-revolutionize-economy

[5] See: https://smeunited.eu/admin/storage/smeunited/200421-am-commission-council-annex.pdf and to somewhat lesser extent: www.businesseurope.eu/sites/buseur/files/media/position_papers/businesseurope_recovery_plan_final_30_04_2020_v2.pdf

However, since supply chains tend to be multi-actor affairs with a potentially long tail of upstream input providers,[6] rearranging them is often not a question of replacing or bypassing one actor or link in the chain. Instead, it may require a complete system overhaul of multiple players and subassemblies that contribute to a finished product. Consequently, if a European industrial buyer seeks to make changes to its supply chain it typically requires a network approach with a helicopter view to alternatives for global supply chains.

Given these premises, cluster associations can be a natural ally for companies that contemplate reconsidering their sourcing practices. This is because cluster organizations are networking engines: they facilitate the interaction between their own members, but also play an increasingly active role in bridging with other clusters. That way, they manage to mobilise and exchange information, know-how, contacts, and opportunities for cluster members, whether at a regional, national, trans-national, international, or sectoral level. In fact, over the past decades, cluster organizations within Europe (and beyond) have been actively pursuing inter-cluster agendas,[7] leading to the formation of networks of clusters,[8] 'meta-clusters',[9] and platforms for cooperation and exchange such as the European Cluster Alliance[10] and the European Cluster Collaboration Platform.[11]

Against this backdrop the aim of this paper is to generate discussion, in first instance among the European Expert Group on Clusters. It seeks to do so by addressing the following questions:

I. What kind of challenges are companies facing in the crisis and in the aftermath of the crisis?
II. What kind of actions and decisions can companies, that have been exposed to supply chain disruptions due to the COVID-19 pandemic, take to cope with these challenges?
III. What value can cluster organizations provide to their members in dealing with the short, medium, and long-term supply chain challenges posed by COVID-19?
IV. What initiatives are cluster organizations already organising?
V. How can policy makers help cluster organizations fulfil their role in this regard?

2. Dealing with the impacts of COVID-19 on industrial supply chains

Based on lessons from previous supply chain "crises" (e.g. the Japanese earthquake of 2011), and conceptual literature on resilient supply chains (Chopra *et al.*, 2014; Sheffi *et al.*, 2005; Sheffi, 2015, 2016; Shih, 2020A, 2020B), the following taxonomical options emerge as regards the ways that companies can manage their supply chains.

[6] Supply chains are often segmented into so-called "tiers", whereby first-tier suppliers tend to be responsible for the design, production and assembly of complete (sub)systems. The second and lower tier suppliers provide more elementary parts to the first-tier suppliers who integrate them into (sub)systems. If a supply chain is segmented into multiple tiers, it can take on the form of a "long tail".

[7] www.elsevier.es/en-revista-journal-innovation-knowledge-376-avance-resumen-inter-clustering-as-network-knowledge-learning-S2444569X18300714

[8] www.clustercollaboration.eu/cluster-networks

[9] www.alpine-space.org/2007-2013/uploads/tx_txrunningprojects/Alps4EU_Meta-Cluster_concept.pdf

[10] https://clustersalliance.eu/es/

[11] www.clustercollaboration.eu

A first consideration that companies can make is to continue buying (outsourcing) inputs from (distantly located) third parties, or to internalize production activities (make in-house).

The former is particularly an option for companies that want to continue acting globally, both for their sales and purchasing practices, and who consider themselves capable of dealing with the encompassing supply chain turbulences.

The latter can in principle be done in two ways:

- Either by the internal creation of a dedicated activity, or
- By acquiring an external company.

A second consideration is with regards to the flows of goods and inputs that a company continues to acquire from third parties. Here it can review the anatomy of the corresponding supply chains, i.e.:

- Whether to shorten the distance that global supply chains can span (e.g. go for regionalization and/or intra-EU chains) or to continue relying on long haul supply chains (e.g. transcontinental).[12]
- Whether to lower the number of tiers within a supply chain or to maintain the same level of tiering.[13]
- Whether to introduce (more) redundancy into supply chains (as in the form of dual or multiple sourcing) or to opt for single sourcing (use of exclusive suppliers).[14]

A third consideration concerns their routing and modal choices. For instance, by considering:

- Whether to opt for alternative transport routes than the ones that the company is currently using.
- Whether to make use of parallel transport routes (sending cargo over more than one trajectory at the time or alternating between them) or to use a single route.[15]
- Whether to apply a modal shift (using other transport modes than the current one(s)) or to cling to the current mode(s).
- Whether to ship goods via parallel modes (dividing the shipments over more than one transport mode) or to rely on a single modality.[16]

Fourthly, and irrespectively of whether a company introduces changes into the routing and modal choices surrounding supply chains and/or the suppliers it will be working with, it can decide to change its vigilance activities with regard to its supply chain activity and partners. Among others, companies can contemplate:

[12] This can include back-shoring options of internal operations that are performed cross-border (perhaps even overseas). It can also include relying on more locally organized circular economy circuits instead of acquiring virgin materials from more distantly located suppliers.

[13] See also footnote 6.

[14] Evidently, not for every link in a supply chain the same choices must be made. For example, a company can have one tier 1 supplier for component X, whereas there can be two tier 2 suppliers for part Y.

[15] Here also, not for every segment along the complete origin-destination combination a company needs to consider multiple trajectories and it may just be an option for specific parts of the routes.

[16] *Idem*: considering the use of multiple transport modes may only be relevant or viable along specific segments along the complete origin-destination combination.

- Raising the level of control exerted on suppliers and on flows of goods that make up the supply chain or sticking to the current control measures and frequency.
- Increasing the degree of formalization of control (certification, homologation, protocolization, …) or staying with the existing degree of transparency.
- Augmenting the speed and depth with which control is exerted (through digitalization, real time intelligence, bigger datasets) or remaining with the current standards.
- Designing a stricter (or more contingent) business continuity plan[17] than the current one (provided there is one) or clinging to the one in place.

Finally, there are complementary decisions about inventory levels, i.e.:

- Whether to build in (more) slack capacity and stock reserves or to (continue to) opt for Just in Time deliveries and Kanban practices.[18]
- Whether to keep stocks in one central place or to work with a distributed network of stocks in different logistics centres.

If we take the above considerations and options together and frame them into a flow chart (see Figure 1), a process emerges whereby companies can adopt different decisions. Departing from the initial situation, companies that are confronted with the COVID-19 pandemic are likely to, subsequently, adopt one or more of the following postures:

1. A reactive attitude, trying to maintain existing supply chains up-and-running as good as possible. This is characteristic of resistance behaviour in the short term after the pandemic starts to impact on business and in the flow chart it is labelled as "Hold out".

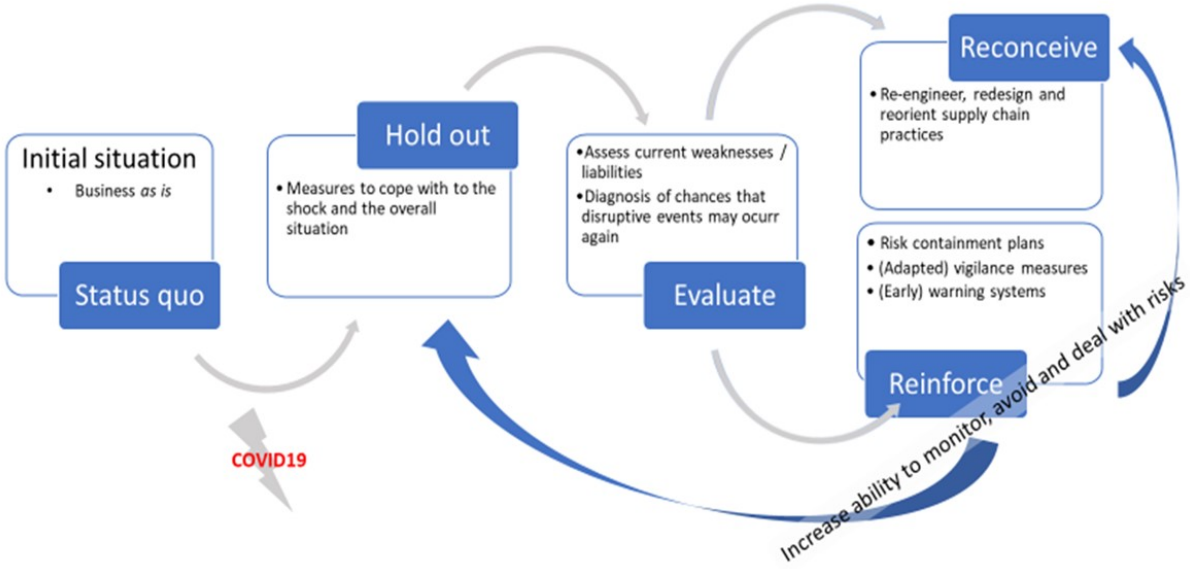
2. In a second stage, companies will typically enter a kind of "evaluation" stage in which they reflect on whether their supply chain *modus operandi* until now can continue or whether changes should occur. This passage is portrayed in the flow chart under the header "Evaluate".

3. Afterwards, and this is like to be the situation at present, most companies will have moved into a phase in which they are reconceiving and/or reinforcing the supply chain practices they had in vigour until early 2020. This will prompt them to either to adopt radical changes to supply chain practices ("Reconceive") or fine-tune and back up the routines in vigour until now ("Reinforce").

[17] The essence of a business continuity plan or a contingent supply plan is to –once a disruption is detected– have a predesigned plan available and to deploy this solution rapidly. It can be likened to an emergency plan that stipulates how to act if a disaster occurs. Such plans typically leverage information technology systems for production, sales and order planning and demand forecasts, inventory levels and information about shipments to ensure that a company can react quickly if incidents occur. Ideally, these plans allow a company to shift production from a plant or supplier in one place to another plant or supplier in another locality when needed.

[18] Again, inventory levels need not be the same for all good, (raw) materials and parts and pieces that a company processes, and they can vary –for instance– in function of the supply risks that their respective manufacturers represent.

Figure 1: Flowchart regarding supply chain rearrangement decisions



Source: own elaboration

With regards to the last part of the flow chart, companies can adopt varying postures at this point. On the one hand, radical "reconceiving", e.g. in the form of a regionalization of supply chains, can be a preferred choice for smaller firms that only import and buy limited volumes from overseas' suppliers. On the other hand, there can be (bigger) firms who want to maintain their positions within Global Value Chains and thus decide to "reinforce" their supply chain practices. That is, incorporate more checks-and-balances into their supply chain management routines and assess much more periodically or continuously how robust their supply chain is.

Given that a definitive solution for the current pandemic is still not in sight, which makes it improbable that business and trade can quickly return to a context without restrictions on the movement of goods and persons, companies will have to combine reconceive with reinforce measures, as reconceiving alone will not be enough.

If we try to operationalize the "hold out", "evaluate" and the "reinforce"-"reconceive" stages from the previous figure, and break them down into concrete action options that firms can consider under each heading, we arrive at the tentative overview presented in Table 1.

Table 1: Anthology of possible decisions to adopt according to character of supply chain (re)design that a company envisages

Character	**Hold out:** • Maintain or fine-tune current practices	**Evaluate** • Reflect on current modus operandi	**Reinforce:** • Raise supply chain transparency • Strengthen control and manoeuvring/adjustment possibilities	**Reconceive:** • Strategic approach to adopt a new vision
Possible measures	• Reactivate relations and flows with/from suppliers of old • Put existing practices back on track and into gear	• Develop "what if" scenarios • Prepare business continuity plans / supply contingency plans • Predefine crisis plans and emergency protocols	Risk containment: • Activate crisis / contingency plans and protocols Vigilance and warning systems: • Tighten supplier evaluation processes • Strengthen or set up (business) intelligence schemes • Conduct supply chain mapping exercises • Identify critical (upstream) dependencies • Create emergency operations centers Recruitment: • Scout (more) actively for alternative suppliers • Set up or strengthen interactions with (local) start-ups and makers Train: • Design and run supplier development programmes • Assist (potential) suppliers in certification processes and the like • Launch contests to test alternative suppliers and fill the funnel of potential suppliers	Resetting the meta-values (KPIs) to govern Supply Chain Management • Revise supplier / purchasing selection criteria, weights of variables and of screening methods Subsequent sourcing options: • Make instead of buy • Acquire / internalize suppliers • Backshoring of own activities abroad • Change suppliers • Dedouble supply relations (dual or multiple sourcing) Subsequent purchasing options: • Shift from purchasing "new" raw materials to circular/"recycled" solutions • Join forces with other companies or enter/create a joint purchasing programme/platform Subsequent production and logistics options: • Make use of 3D printing to supplement or substitute the supply of certain inputs • Amplify stock keeping and safety reserves as an alternative to (full-fledged) JIT and lean logistics / manufacturing • Consider alternative transport modes and routes

Source: own elaboration

3. How can cluster organisations help addressing supply chain challenges?

3.1 Applying cluster support functions to the context of supply chain challenges

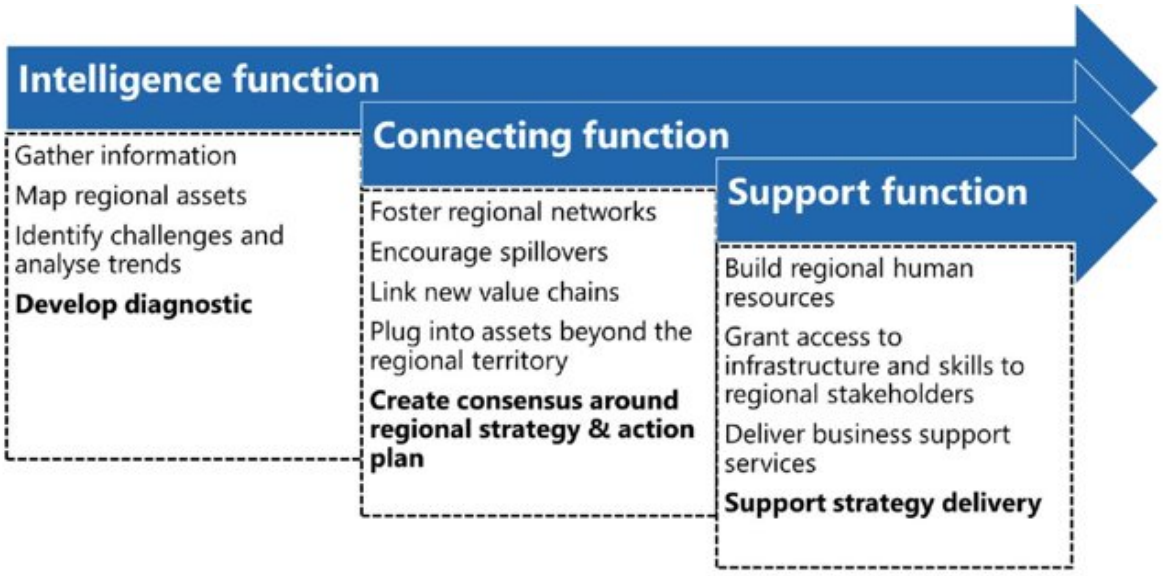
The activities that cluster organizations can undertake to support the increased international competitiveness of their members can be grouped in three different functions (see Figure 2):

1. Intelligence function: Gathering information from a wide range of stakeholders and mapping assets and potential markets.

2. Connecting function: Fostering networks that enhance knowledge spillovers between research and industry, within and across supply chains.

3. Support function: Supporting the development and delivering of business support services for cluster companies to improve innovation, skills and productivity.

Figure 2: Roles of cluster organizations



Source: European Observatory for Clusters and Industrial Change, 2019

Looking at the three functions that cluster organizations can fulfil and the ultimate postures that companies can adopt as identified in section 2 ("reinforce" or "reconceive"), the two can be interconnected in the following four areas of support:

- Cluster organizations can **gather intelligence** on potential new supply chain partners and for improved design of contingency and continuity plans ("reinforce").

- Cluster organizations can **connect companies** to new partners and help to (re)build ecosystems ("reconceive").

- Cluster organizations can also **support companies** in the **development of new suppliers** and contribute to the building of required capabilities ("reinforce").

- Cluster organizations can provide **long term guidance** (e.g. for circular economy strategies), enabling companies to **build sustainable supply chains for the future** ("reconceive").

In what follows, we discuss each of these four areas of support.

Intelligence gathering

Many cluster organizations in the EU already provide market intelligence to their members on both potential suppliers and potential sales markets. These existing work streams can be extended to cover the risks posed by different supply chains, enabling companies to make better risk assessments. Consequently, companies can make better decisions about resources needed and the right mix of suppliers to minimize supply risks. Such risk information could take the form of comprehensive dashboards that lay out the full status of production and shipment or the form of scenario modelling or supply chain and supplier mapping exercises. Additionally, supply chain intelligence gathering could also give way to sharing knowledge on transport modes and transport routes and their risk factors at a certain date. Their connection to own members and access to members of other clusters can also allow cluster organizations to check out supplier references when a specific company considers entering a supply relation with a new provider that already serves companies affiliated to allied clusters.

Ecosystem (re)building

Cluster organizations can support companies by facilitating new connections to rebuild their supply chains. Cluster organizations can fill this role more easily than, for example sectoral organizations, since they are built around supply chains and therefore include organizations that occupy different positions along such chains. With their connections across member states (for example via the European Clusters Alliance or the European Cluster Collaboration Platform) they are well-positioned to provide contacts that will especially help small and medium-sized companies building less risky supply chains. Particularly in those cases that companies want to go for European supply partners, cluster organizations can be highly useful due to the intensified networking practices among them since the pandemic broke out.

More generally, cluster organizations can foster a move towards more cooperative ecosystems, and thereby increase the competitiveness of industrial ecosystems from Europe internationally.

Finally, and although there can be firms that may want to hold on to their current suppliers, given the prolonged uncertainty that may be ahead, clusters can also nudge firms to broaden their sourcing options (supplier diversification). This is a very important point as many European companies work with exclusive / single suppliers of specific inputs, which makes them extremely vulnerable if something happens in a given country or with a specific supplier. The key here is not to give up on long distance suppliers, but to lower the dependence on exclusive suppliers. Certainly, for those companies that buy large volumes of specific goods, multiple sourcing seems worth considering.

Company support and supplier development

Opting for alternative, local, suppliers can contribute to reducing supply chain risks, but it likewise requires a capability building process to get the new suppliers up to level. Most firms that decide to strengthen their local supply base will not want to merely trade cost and tried-and-true value from abroad for proximity. They will need their local suppliers to provide the same quality guarantees that they are/were receiving from distant suppliers. This implies that (newly recruited) local suppliers will also have to –if applicable– certify and homologize their products and processes and get their IT infrastructure up to par with the respective industry standards that apply to them. The former imposes content requirements for supplier development programs and on local supply relationships compliance with industry standards. Hence, cluster organizations can support members via the design of design of supplier development programmes and in professionalizing their supplier evaluation practices.

Greening the economy and circular economy

Their independence and distance from the day-to-day decisions that companies need to make implies that cluster organizations can also play a key role in fostering a long-term vision with respect to the eventual turnaround and morphing of members' business activities. For certain firms the experiences over the past months may form a point of inflection, making them develop a preference to go for local and greener supply, and/or to become interested in a reorientation of their business or the industrial ecosystem they form part of towards future-oriented business propositions of a circular or foundational economy character.

The former may well fit into the context of the Europe's green transition and the New Green Deal towards more sustainable supply chains. As pursuing circular economy strategies will also entail sewing up alternative supply chains, cluster organizations are well placed to play an intermediary role to help their members in creating the necessary supply links and embedding them into circular ecosystems.

3.2 Examples of cluster actions focusing on supply chain safeguarding or rebuilding

Many cluster organizations have already started to put measures in place that target the rebuilding of supply chains, as described above. Table 2 provides an overview of initiatives that are currently working to that end. The cluster measures identified have been categorised using the labels from the flow chart in chapter 2.

It is important to note that many of the examples currently observed are more fitting the categories of re-establish and reconsider, while only a few examples for reconceive and no examples for reinforce could be identified. This is probably due to timing since the ongoing work that would fit into these categories may have not yet started or may not be public knowledge.

Table 2: Examples of relevant cluster support measures

Cluster measure	Country	Description
Hold out		
Supporting the health Sector (Connecting)	FI	In North-East Finland[19] clusters have played a vital role in adapting production to the needs of the crisis. Examples are the adaptation of alcoholic beverage production to the production of hand sanitizer or support for local hospitals organized and initiated by cluster organizations.
Supporting the health Sector (Connecting)	FR	French cluster organizations[20] have provided similar support for companies in adapting to the crisis, involving the textile sector, services for higher at-risk seniors or the development of digital solutions.
Supporting the health Sector (Support)	CA	The industry-led Supercluster Next Generation Manufacturing Canada (NGen)[21], will invest €30 million to support companies preparing to produce critically needed technologies, equipment, and medical products to aid in the fight against COVID-19.
Supporting the health Sector (Support)	ES	In Spain, members of the packaging[22] cluster have coordinated their response to COVID-19. A number of initiatives have been conducted including the development of protective equipment by technology centers or the development of protection screens by machinery manufacturers.
Allowing firms to continue activity (Connecting)	ES	The advanced materials cluster "MAV" from Catalonia acted as a bridge between individual protection equipment manufacturers from Spain and a foreign supplier of raw material. This led to the establishment of a new, additional, supply relationship, allowing the users of this equipment to continue with their business activity, the Spanish manufacturers to increase their output and the French supplier to enter a new commercial relationship.
Allowing firms to continue activity (Connecting)	ES	Cluster organisations from the Basque Country set up a central purchasing centre for buying and delivery of protection equipment (both from local and Chinese suppliers) for their member companies. In addition, they paved the way -together with the Regional Health System- for the local manufacturing of medical devices, such as ventilators, and production lines for large volume of testing swabs and diagnostic kits, including standards technical appraisal.
Evaluate		
Rethinking Innovation (Intelligence)	DK	Cluster Excellence Denmark have published a discussion paper[23] on "rethinking innovation in the times of crisis". The paper discusses how standard "cluster tools" like match making, research partnerships, incubation and internationalization and others can be used during and after the crisis.
Reinforce		

[19] www.clustercollaboration.eu/news/how-clusters-east-and-north-finland-support-their-businesses-find-solutions
[20] www.clustercollaboration.eu/forum/best-practices-sharing/french-clusters-stay-mobilized-fight-covid-19-few
[21] www.clustercollaboration.eu/profile-articles/ngen-announces-funding-program-scale-covid-response
[22] www.clustercollaboration.eu/profile-articles/discover-everything-members-cluster-have-done-combat
[23] www.clusterexcellencedenmark.dk/Files/Images/Filer%20til%20direkte%20visning/Rethinking%20Innovation%20%E2%80%93%20Danish%20Clusters%E2%80%99%20Response%20to%20the%20Covid-19%20Crisis.pdf

Cluster measure	Country	Description
Plexiglass task force (Intelligence)	ES	In the wake of supply shortages of plexiglass, the advanced materials cluster "MAV" from Catalonia took part in a task force to go after the reasons for this shortage and to see what alternative solutions could be found. Consequently, substitute materials were proposed, as well as complementary protection measures and novel production processes, leading easier to produce and more economic manufacturing methods.
Mobilizing collective intelligence from clusters (Intelligence)	ES	Cluster organisations in the Basque Country helped the Basque Government collect information about the immediate impacts and needs of SMEs. This joint taskforce has built a set of measures to implement at company, cluster and administration level: Cluster Reactivation Road Maps. Intelligence reports on logistics, international markets, market prospects, travelling restrictions.
Reconceive		
Restoring disrupted supply chains (Connecting)	EU	The EC European Commission and ECA European Cluster Alliance have set up a new cross-sectoral and multi-level network across Europe to find solutions and share experiences. Started as an informal search for 3D printing capacities and turned into a group of experts collaborating with the European Commission and national networks. The EAAC focuses on understanding reality, naming needs, identifying potential solutions and transferring them to their networks to act, and is working in an ongoing manner on the identification and relief of disrupted supply and value chains in the EU.

4. Implications for policy makers

The previous sections show an alignment between the main tools of cluster policy and the actions of clusters (intelligence, support and connect) with the needs of companies in the COVID-19 recovery phase (re-establish, reconsider, reinforce and reconceive).

The biggest challenge for cluster policy makers is to provide cluster organisations with both the right type of guidance and signposting as well as the needed resources to be able to fulfil their roles. Accordingly, cluster policy makers can support clusters through the following measures:

- ***Considering resource needs and responsibilities for clusters:*** While the missions that clusters pursue has not changed, the versatility of the domains on which they need to act has broadened, which implies they need to expand their skill base and scope of attention. Meanwhile, funding opportunities or available resources have not evolved equally. Policy makers need to be aware of this and evaluate whether the funding opportunities for clusters are sufficient and appropriate for the activities they are expected to undertake.

- ***Strategic guidance:*** Both for 'evaluate', 'reinforce' and 'reconceive' ventures, members of cluster organizations can benefit from guidance to ensure that their supply chains considerations and decisions align with long term outlooks. This also implies that cluster

support is likely to get a more dynamic character and that forward-looking activities and vigilance may take a more central spot in the assistance that cluster organizations might take up to the benefit of its members. Similarly, guiding members within the context of circular economy endeavours may require cluster organizations to amplify their knowledge base.

- ***Information:*** Lastly, cluster policy makers can also support clusters by endowing them with and training them in the use of information (gathering) systems.

The following table shows how firm level responses to the supply chain shocks caused by COVID-19 align respectively with types of cluster response and corresponding implications for policy makers.

Table 3: From firm-level responses to supply chain disruptions to policy levers

Firm level response	Time frame	Cluster response	Policy implication
Hold out	Short term	Emphasis on **supporting**	• Provide budget support to cluster organization and ease conditions of financial support to allow for reorientation (e.g. in context of existing S3 strategies) • Provide liquidity support to SMEs, including through cluster organizations • Sector specific support for sectors that are especially hard hit: e.g. tourism • Specific support for sectors that are particularly helpful in addressing the immediate fallout of the crisis: health sector, advanced manufacturing (of health and pharmaceutical products) • Promoting cluster policy as an important tool in the crisis
Evaluate	Mediu m-term	Emphasis on **intelligence**	• Emphasise regional competences and regional networks • Incorporate supply chain management into innovation, start-up and scale-up models • Provide support for mapping regional assets and identifying trends (vigilance activities) • Inclusion of cluster organizations in the development of long-term economic strategies (e.g. circular economy) to make them both practical and help clusters in their strategic thinking
Reconceive	Long term	Emphasis on **connecting and supporting**	• Provide incentives for clusters to network among each other, and to create inter-regional/transnational networks among each other (e.g. matchmaking) • Provide funding for pilots, tests, experimentation with alternative supply chain management models and alternative approaches to innovation, start-up and scale up models • Support for establishing regional network activities and assembling new regionally based or more secure supply chains • Boost access of clusters to knowledge and experiences around resource efficiency and circular economy that can support a green reconceiving of supply chains

Firm level response	Time frame	Cluster response	Policy implication
Reinforce	Long term	Emphasis on **connecting and intelligence**	• Link financial support to strategic reorientation • Provide strategic direction for cluster organizations to anchor their activities in e.g. green economy, circular economy, digital transformation, collaborative working • Build out regional human resource base (education and VET, regional attractiveness) • Open regional infrastructure (research, data, public resources and administration)

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