Série dos Seminários de Acompanhamento à Pesquisa

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Disasters' impacts and countermeasure strategies on supply chains

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Mestrado (2017-2019)

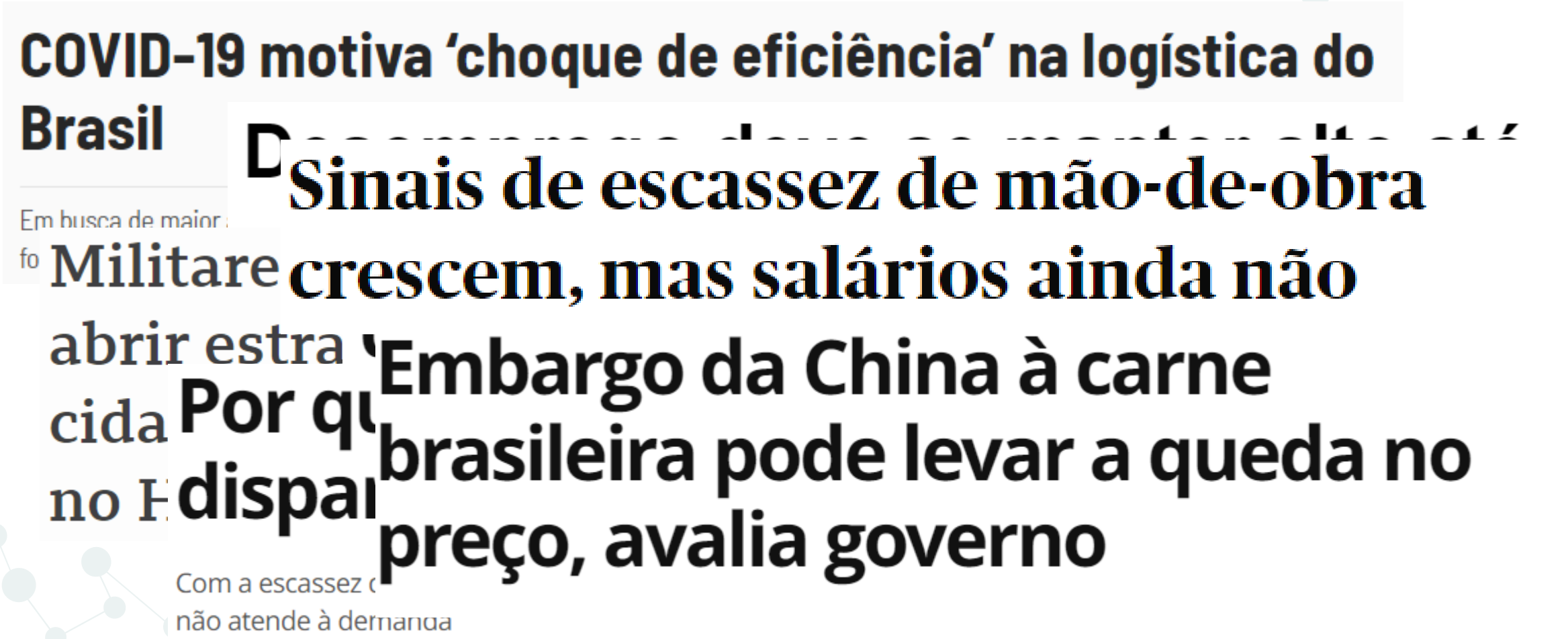
- Logística Humanitária e Gestão de Operações em desastres (avaliação de desempenho em operações humanitárias pela perspectiva do beneficiário)

Honorary Mention at the HUMLOG Best Master Thesis Award 2020

Doutorado (2019-2023)

- Operações e Negócios em Engenharia – ONE.
  - Logística Humanitária e Gestão de Operações em desastres (desastres em cadeias de suprimentos)

Thesis context



Thesis context

SCs disruptions are often caused by disasters (Ivanov et al., 2017; Xu et al., 2020; Ivanov and Dolgui, 2021).

Recently, the COVID-19 pandemic negatively affected different SCs such as food (Aday and Aday, 2020; Bassett et al., 2021; Farrell et al., 2020; Ali et al., 2020; al., 2021), manufacturing (Cai and Luo, 2020; Belhadi et al., 2021), services SC (Ngin et al., 2020; Assaad et al., 2021), and global SCs (Xu et al., 2020; Al-Mansour and Al-Ajmi, 2020).

Thesis context

Identify the main disasters impacts on supply chains and propose appropriate strategies to prepare supply chains during the disaster.

How should SCs prepare to respond to disasters' impacts?

Publicações relacionadas a tese

- Sustainability Journal (2021) – A1:

Cardoso, B., Cunha, L., Leiras, A., Gonçalves, P., Yoshizaki, H., de Brito Junior, I., & Pedroso, F. (2021). Causal Impacts of Epidemics and Pandemics on Food Supply Chains: A Systematic Review. Sustainability, 13(17), 9799. Causal Impacts *of Epidemics and Pandemics on Food Supply Chains: A Systematic Review.* (aprovado)

- ENEGEP (2021):

Quintela, A. C.; Machado J. M. M.; **Cardoso, B. F. O.** (2021). Impacto da pandemia de COVID-19 em cadeias de suprimentos: um estudo de caso múltiplo. In: Encontro Nacional de Engenharia de Produção – ENEGEP 2021 (aprovado)

Cardoso, B. F. O.; Silva, J. F. (2021). *Applications of structural equation modelling in humanitarian operations: a literature review.* In: Encontro Nacional de Engenharia de Produção – ENEGEP 2021 (aprovado)

- POMS (2021):

Cardoso, B., Cunha, L., Leiras, A., Gonçalves, P., Yoshizaki, H., de Brito Junior, I., & Pedroso, F. (2021). *COVID-19 impacts and mitigation strategies on food supply chains: a survey to the Brazilian.* In: Production and Operations Management Society Lima Virtual Conference 2021 – POMS Lima (aprovado – aguardando publicação)

Cardoso, B. F. O.; Fontainha, T. C.; Leiras, A. (2021). *Disasters' impact on supply chains and overcoming strategies: a bibliometric analysis*. In: Production and Operations Management Society Lima Virtual Conference 2021 – POMS Lima (aprovado – aguardando publicação)

Publicações relacionadas a tese

Trabalho de Conclusão de Curso (concluído – 2020): "Impacto da pandemia de COVID-19 na cadeia de suprimentos: um estudo de caso".

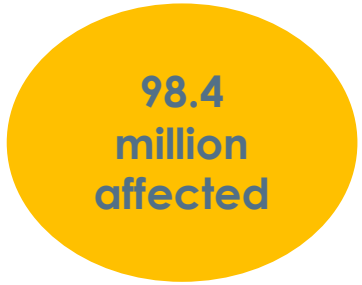
Trabalho de Conclusão de Curso (em desenvolvimento): "Segurança alimentar de populações vulneráveis em meio a pandemia de COVID-19: uma análise no Complexo do Alemão – Rio de Janeiro".

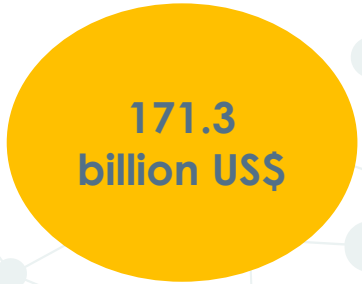
Projeto desenvolvido em parceria com outras instituições e financiado pelo Banco Mundial, intitulado "*Scaling-up actions for disaster management in Brazil*" (2020 – 2021).

PAPER 2

Looking back and forward disaster readiness of supply chains

Introduction





Source: CRED (2021)

Disasters are severe disturbances due to dangerous events that cause human, material, economic and environmental losses, and damages, besides affecting the functioning of a community or society at any scale (UNISDR, 2009).

The different approaches involve SC performance in terms of **SC resilience** (Farrell et al., 2020; Van Hoyweghen et al., 2021), **SC robustness** (Khurana et al., 2021; El Baz and Ruel, 2021), **SC stability** (Boyacı-Gündüz et al., 2021; Al-Mansour and Al-Akmi, 2020) **and SC viability** (Chari and Ngcamu, 2019; Ivanov and Dolgui, 2021).

Goal and research question

To establish readiness to respond to disasters, SCs managers need to understand the extent of impacts, formulate response strategies and reconfigure their resources to strengthen capabilities and adapt to the ensuing effects (Cardoso et al., 2021; Norwood and Peel, 2021; Belhadi et al., 2021).

Identify and theoretically relate the major adverse disasters' impacts on SCs and the countermeasure strategies to mitigate the negative effects on supply chain performance.

1. **What are the major disasters' impacts on SCs and countermeasure strategies?**
2. **How to synthesize the impact assessment on SCs, considering the relationship between impacts, countermeasure strategies, and SC performance?**

Materials and methods

Systematic Literature Review (SLR) through an eight-step process, as detailed in Thomé et al. (2016):

(i) planning and problem formulation,

(ii) literature search,

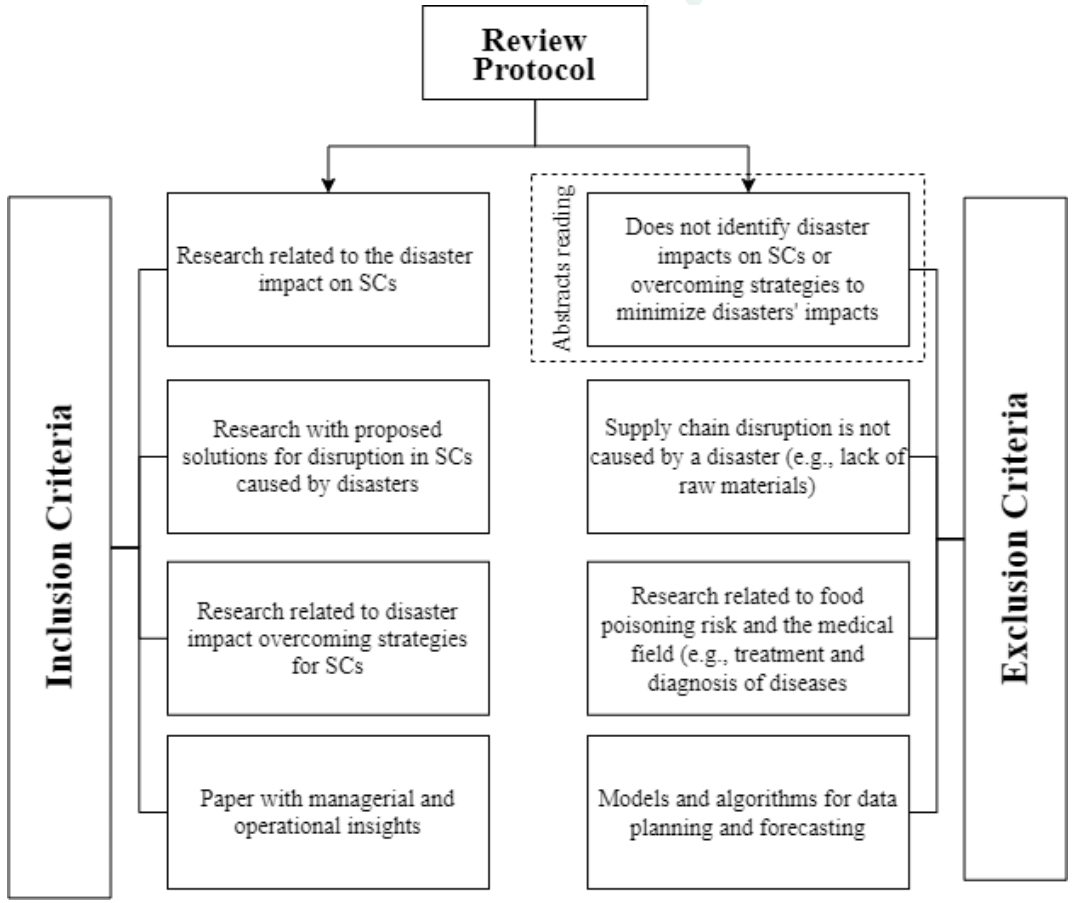
(iii) data gathering,

(iv) quality evaluation,

(v) data analysis and synthesis, interpretation,

(vi) presenting the results, and

(vii) review updating.



Materials and methods

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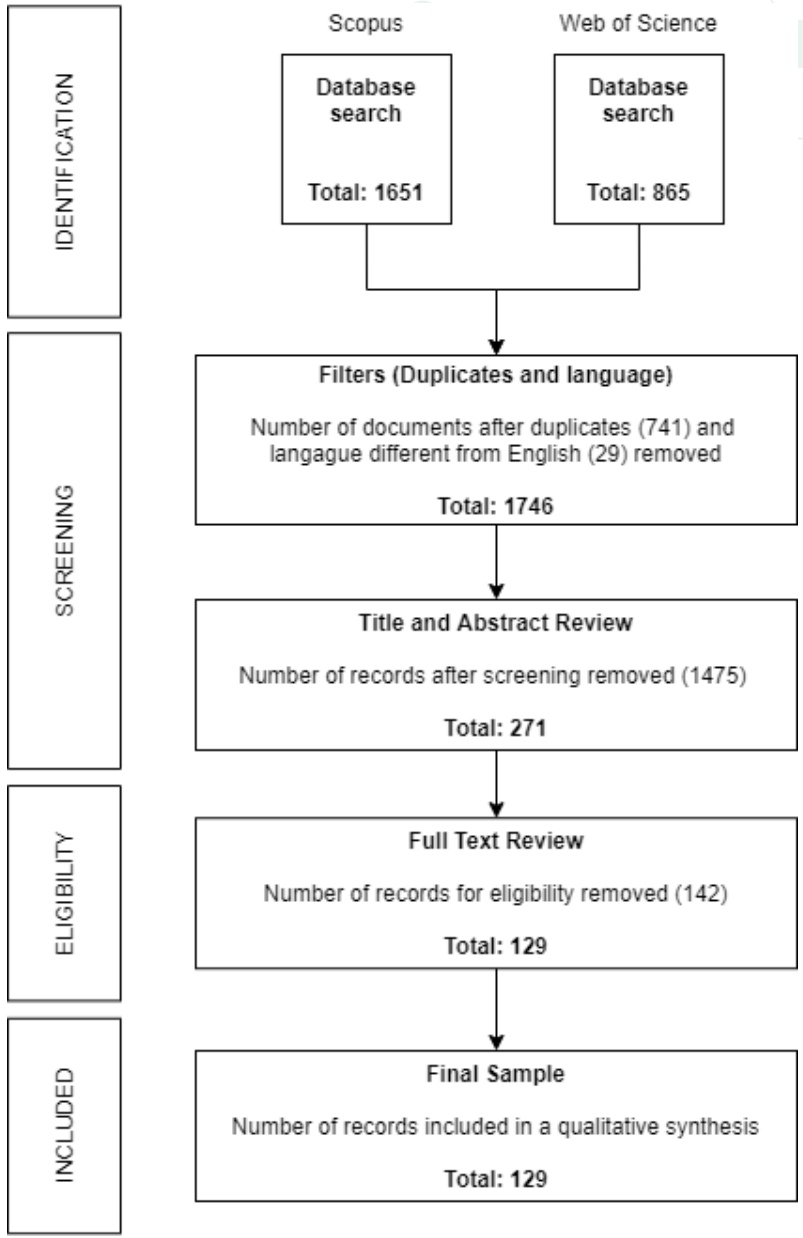


Taxonomy

➢ Example

Resources constraints	Workforce shortages	Abu Hatab et al. (2021a); Assaad and El-adaway (2021); Cai and Luo (2020); Chitrakar et al. (2021); Davila et al. (2021); Deaton and Deaton (2020); Deconinck et al. (2020); Fan et al. (2021); Farrell et al. (2020); Garlick et al. (2020); Giunipero et al. (2021); Gu and Wang et al. (2020); Abu Hatab et al. (2021b); Hayes et al. (2020); Hobbs (2020); Hobbs (2021b); Jamwal and Phulia (2020); Khalfan and Ismail (2020); Kumar et al. (2020); Kumaran et al. (2021); Kumaran et al. (2021); Marquez et al. (2021); Memon et al. (2021); Mishra et al. (2021); Notteboom et al. (2021); Okorie et al. (2020); Pujawan and Bah (2021); Ratnasignam et al. (2020); Rukasha et al. (2021); Siche et al. (2020); Sid et al. (2021); Singh et al. (2020); Taqi et al. (2020); Tellioglu (2021); Tran et al. (2020); Van Hoyweghen et al.	SC automation and digitalization	Disruptive innovation and technology	Coluccia et al. (2021); Jamwal and Phu	Business continuity plans	Administrative controls	Assaad and El-adaway (2021); Sid et al. (2021)
				SC automation and digitization	Hobbs (2020)		Crisis management plan	Giunipero et al. (2021)
			Human capabilities	HR capacity	Okorie et al. (2020); Tran et al. (2020)		Contigency plans	Notteboom et al. (2021); Pujawan and Bah (2021); Ratnasignam et al. (2020); Tran et al. (2020); Hobbs (2021b); Weersink et al. (2021)
						Resources maintenance	Remote work	Boyacı-Gündüz et al. (2021); Cai and Luo (2020)
							HR management	Coopmans et al. (2021); Cundell et al. (2020); Garlick et al. (2020); Kumar et al. (2020); Snowdon et al. (2021); Taqi et al. (2020)
Resources constraints	Supply (input), equipment and services shortages	Abe and Ye (2014); Abu Hatab et al. (2021a); Aljadeed et al. (2021); Assaad and El-adaway (2021); Bookwalter (2021); Boyacı-Gündüz et al. (2021); Cai and Luo (2020); Chitrakar et al. (2021); Chtioui et al. (2020); Cundell et al. (2020); Davila et al. (2021); Deconinck et al. (2020); Erlina and Elbaar (2021); Fan et al. (2021); Haraguchi and Lall (2015); Abu Hatab et al. (2021b); Iwase (2011); Jamwal and Phulia (2021); Khalfan and Ismail (2020); Kumar et al. (2020); Kumaran et al. (2021); Liu et al. (2020b); Macmahon et al. (2015); Marquez et al. (2021); Miller (2011); Musa and Basir (2021); Nasution et al. (2020); Nordhagen et al. (2021); Notteboom et al. (2021); Palouj et al. (2021); Park et al. (2013); Qin et al. (2021); Ratnasignam et al. (2020); Scala and Lindsay (2021); Sharma et al. (2020); Sid et al. (2021); Sodhi and Tang (2021); Taqi et al. (2020); Tellioglu (2021); Tran et al. (2020); Van Hoyweghen et al. (2021); Xu et al. (2020); Zhu et al. (2020)	SC collaboration	SC preparation and integration	Abe and Ye (2014); Park et al. (2013)	SC collaboration	Public-private cooperation	Abe and Ye (2014)
				Collaboration/coordination	Cundell et al. (2020); Fan et al. (2021);	Information system	Warning systems	Aljadeed et al. (2021)
			Local SC	Alternative supply sources	Bookwalter (2021); Cundell et al. (202		Communicating information	Abu Hatab et al. (2021b); Bookwalter (2021)
				Identify critical suppliers	Ivanov and Dolgui (2021)	Business continuity plans	Business continuity plans	Cundell et al. (2020)
				Local suppliers	Macmahon et al. (2015); Musa and Ba		Administrative controls	Assaad and El-adaway (2021)
				Purchasing policy	Chtioui et al. (2020)		Free supply of essential goo	Kumaran et al. (2021)
			SC automation and digitalization	Communicating information tecnology	Bookwalter (2021); Davila et al. (2021)		Governement assistance	Liu et al. (2020b)
				Supply Chain Digitalization	Cai and Luo (2020)		Crisis Management Committ	Davila et al. (2021)
						SC collaboration	Collaboration/coordination	Cundell et al. (2020); Fan et al. (2021); Tran et al. (2020); Van Hoyweghen et al. (2021); Sodhi and Tang (2021); Tellioglu (2021); Scala and Lindsay (2021); Sharma et al. (2020)
						Resources maintenan	Reserves of inventory	Sodhi and Tang (2021); Haraguchi and Lall (2015)
Resources constraints	Infraestructure constraints	Aday and Aday (2020); Belhadi et al. (2021); Cai and Luo (2020); Chari and Ngcamu (2019); Chari and Ngcamu (2017); Chtioui et al. (2020); Deconinck et al. (2020); Erlina and Elbaar (2021); Fu et al. (2020); Garlick et al. (2020); Haraguchi and Lall (2015); Abu Hatab et al. (2021b); Hayes et al. (2020); Hobbs (2021b); Ijaz et al. (2021); Ino and Watanabe (2021); Iwase (2011); Kim and Bui (2019); Kumar et al. (2020); Lenzen et al. (2019); Magableh (2021); Marchant-Forde and Boyle (2020); Marquez et al. (2021); Marszewska (2016); Martinez et al. (2021); Marzantowicz et al. (2020); Miller (2011); Norwood and Peel (2021); Notteboom et al. (2021); Park et al. (2013); Ping and Na (2021); Pratama et al.	SC automation and digitalization	SC Digitalization	Cai and Luo (2020); Belhadi et al., (202	Business continuity plans	More funding	Chari and Ngcamu (2017); Belhadi et al., (2021)
				Digital transformation	Fu et al. (2020); Trovão (2020)		Relaxation of laws/regulation	Ino and Watanabe (2021)
			SC Collaboration	Risk management program	Norwood and Peel (2021); Belhadi et a		Flexible layout	Kumar et al. (2020)
				SC integration	Park et al. (2013); Zhu et al. (2020)		Assistance governement	Martinez et al. (2021); Pratama et al. (2021)
			Resources maintenance	Improving infrastructure	Abu Hatab et al. (2021b); Nasution et	SC Collaboration	Alternate locations of produ	Haraguchi and Lall (2015)
				Capacity management	Deaton and Deaton (2020); Notteboo		Network relationship	Pratama et al. (2021); Belhadi et al., (2021)
						Virtual marketplace	Online market	Ijaz et al. (2021); Ratnasignam et al. (2020); Belhadi et al., (2021)

Taxonomy

- **IMPACTS (categories)**

- **Resource constraints:** refers to the resources scarcity that are essential for the development of activities (e.g., workforce);
- **SC instability:** frequent SC fluctuations and oscillations generate future uncertainties and impact decision-making (e.g., prices)
- **Outflow disruption:** disruption of the normal flow of the SC affects both upstream and downstream parts of the process (e.g., export and import restrictions)
- **Financial constraints:** refers to the difficulties in controlling and planning financial activities;
- **Consumption patterns:** disasters generate rapid and dynamic changes in consumption habits and patterns, as consumers need to deal with new priorities.

Taxonomy

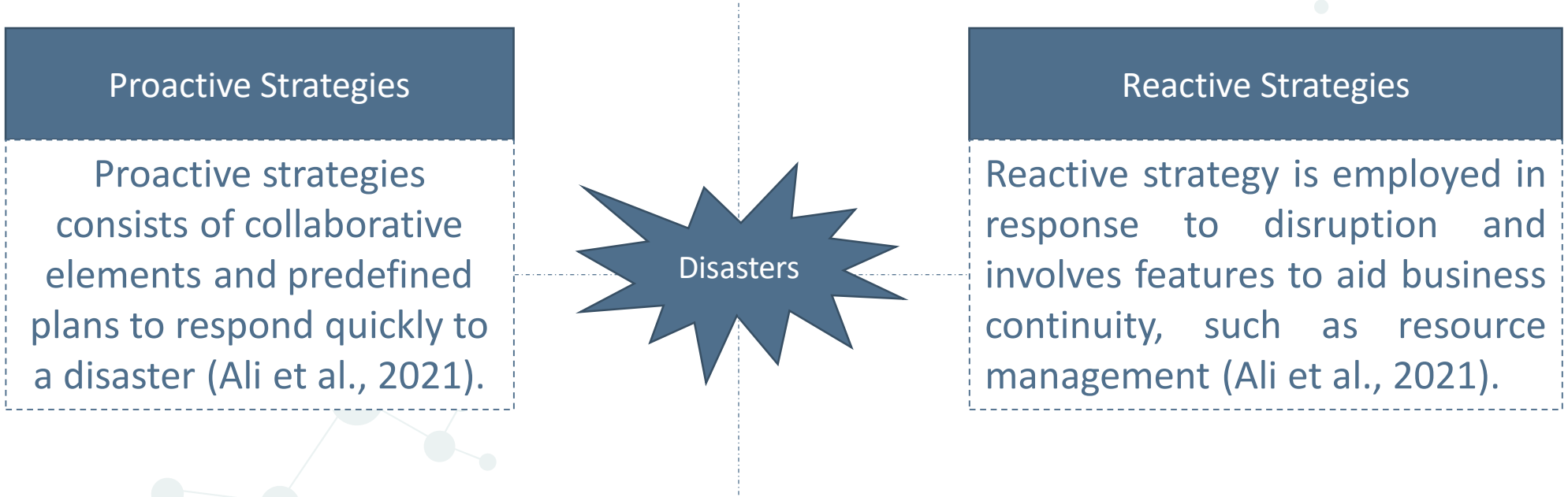
- **IMPACTS (categories)**

Impact Category	Impact
Resources constraints	Workforce shortages
	Supply, equipment and services shortages
	Infraestructure constraints
SC instability	Salles instability
	Inventory instability
	Capacity constraints
	Supply instability
	Demand instability
	Packaging change
	Prices instability
	Productivity instability
	Inputs losses (e.g., product expiry)

Impact Category	Impact
Outflow disruption	Delivery/Distribution restrictions
	Production disruption
	Transport disruption
	Movement of goods restriction
	Movement of people restriction
	Trade relationships restrictions
	Export and import restrictions
Financial constraints	Working capital losses
	Revenue and profit losses
	Operation costs instability
Consumption patterns	Change in consumer behavior
	Income losses
	Job losses

Taxonomy

- **STRATEGIES**



While anticipatory ability refers to the ability to detect potential critical impacts that may adversely affect actors' performance, responsiveness reflects the ease with which actors can implement changes to maintain good performance under varying circumstances (Coopmans et al., 2021).

Taxonomy

➢ **PROACTIVE STRATEGIES**

- **SC Collaboration:** Firms at every tier of the SC should work closely together to meet shared objectives of predicting and preventing potential threats in the SC;
- **Resources maintenance**: Resources system and lifeline before disruption should be maintained;
- **Automation/Digitalization:** Refers to digital technologies and systematizing physical and information workflow across the SC to improve processes;
- **Local SC:** Sourcing (and processing) are localized within the same region to meet the local demand and reduce SC globalization;
- **Human capabilities:** Refers to the human capabilities concerning the analysis of enormous information, monitoring, and controlling critical SC points.

Taxonomy

➢ REACTIVE STRATEGIES

- **SC Collaboration:** Firms at every tier of the SC should work closely together to meet shared objectives of recovery and assist each other to mitigate disruption impact;
- **Resources maintenance:** Resources system and lifeline during disruption should be maintained;
- **Virtual marketplaces**: Refers to the development of a digital marketplace for delivering the products and services;
- **Information system:** SC information systems collect, process, and extract meaningful insights from real-time data across the overall SC to support suitable and timely decision-making.
- **Business continuity plans:** Business continuity planning is of the utmost importance to create processes and systems of prevention and recovery to deal with potential disruption in the supply chain.

Taxonomy

Impacts/ SC	SC instability	Outflow disruption	Resources constraints	Financial constraints	Consumption patterns
Food and Beverage	54	47	38	23	25
Manufacturing	19	19	17	14	7
Healthcare	9	7	8	2	1
Services	3	3	3	3	2
General (unspecified)	25	24	20	10	12
Total	**110**	**100**	**86**	**52**	**47**

	No article addressing an impact (0 papers)
	Low quantity of papers addressing the impact (from 1 to 10)
	Regular quantity of papers addressing the impact (from 11 to 20 papers)
	Large quantity of papers addressing the impact (more than 20 papers)

Taxonomy

	Proactive Strategies					Reactive Strategies				
	SC collaboration	Digitalization/ automation	Local SC	Resources maintenance	Human capabilities	Business continuity plans	SC collaboration	Resources maintenance	Information system	Virtual marketplaces
Food and Beverage	19	19	11	10	1	28	22	4	4	8
Manufacturing	8	12	6	4	3	12	8	6	2	3
Healthcare	6	3	6	1	1	4	4	4	3	0
Services	3	2	3	2	1	4	3	1	1	1
General (unspecified)	14	10	9	6	1	12	10	4	3	1
Total	**50**	**46**	**35**	**23**	**7**	**60**	**47**	**19**	**13**	**13**

	No article addressing an impact (0 papers)
	Low quantity of papers addressing the impact (from 1 to 10)
	Regular quantity of papers addressing the impact (from 11 to 20 papers)
	Large quantity of papers addressing the impact (more than 20 papers)

Taxonomy

Impacts/ Countermeasure strategies		Resources constraints	SC instability	Outflow disruption	Financial constraints	Consumption patterns	TOTAL
Proactive Strategies	SC collaboration	16	23	28	3	1	71
	Resources maintenance	11	5	7	12	0	35
	Digitalization/automation	14	30	12	3	0	59
	Local SC	26	5	6	2	0	39
	Human capabilities	1	5	1	2	0	9
						TOTAL	213
Reactive Strategies	SC collaboration	13	23	17	6	1	60
	Resources maintenance	11	10	1	2	0	24
	Information system	4	7	4	4	0	19
	Virtual marketplaces	3	4	9	4	0	20
	Business continuity plans	21	18	23	13	7	82
						TOTAL	205

	No article addressing an impact (0 papers)
	Low quantity of papers addressing the impact (from 1 to 10)
	Regular quantity of papers addressing the impact (from 11 to 20 papers)
	Large quantity of papers addressing the impact (more than 20 papers)

Taxonomy

#	SC performance/ Countermeasure Strategies	Resilience	Robustness	Stability	Viability	TOTAL
Proactive Strategies	SC collaboration	27	8	13	5	53
	Resources maintenance	11	4	4	2	21
	Digitalization/automation	26	11	10	8	55
	Local SC	13	8	7	3	31
	Human capabilities	1	0	0	0	1
					TOTAL	161
Reactive Strategies	SC collaboration	17	6	13	3	39
	Resources maintenance	8	3	4	3	18
	Information system	3	0	1	0	4
	Virtual marketplaces	5	1	5	0	11
	Business continuity plans	27	11	13	8	59
					TOTAL	131

	No article addressing an impact (0 papers)
	Low quantity of papers addressing the impact (from 1 to 10)
	Regular quantity of papers addressing the impact (from 11 to 20 papers)
	Large quantity of papers addressing the impact (more than 20 papers)

Hypotheses and framework

Effective mitigation strategies can minimise losses caused by SC disruptions (Gao et al., 2019). In general, ensuring continuity of activities must be a priority for everyone involved in the SC processes. For this, readiness is crucial that reflects the ease with which actors can implement changes to maintain good performance in variable circumstances, such as a disaster (Hobbs, 2020; Coopmans et al., 2021). Interestingly, everyone involved in the SC can benefit from preparedness measures, facilitating effective communication between all stakeholders (Aljadeed et al., 2021).

- ✓ **H1. Proactive strategies influence positively disasters impacts**
- ✓ **H2. Reactive strategies influence positively disasters impacts**

Hypotheses and framework

Researchers and managers note the need to focus on reconfiguring a more robust, resilient, stable and viable SC to prevent, reduce the impacts of such shocks and disruptions (Haraguchi et al., 2015; Khurana et al., 2015; Khurana et al., al., 2021; Ivanov and Dolgui, 2021; Magableh, 2021).

- ✓ **H3. Supply chain performance is negatively influenced by disaster impacts**

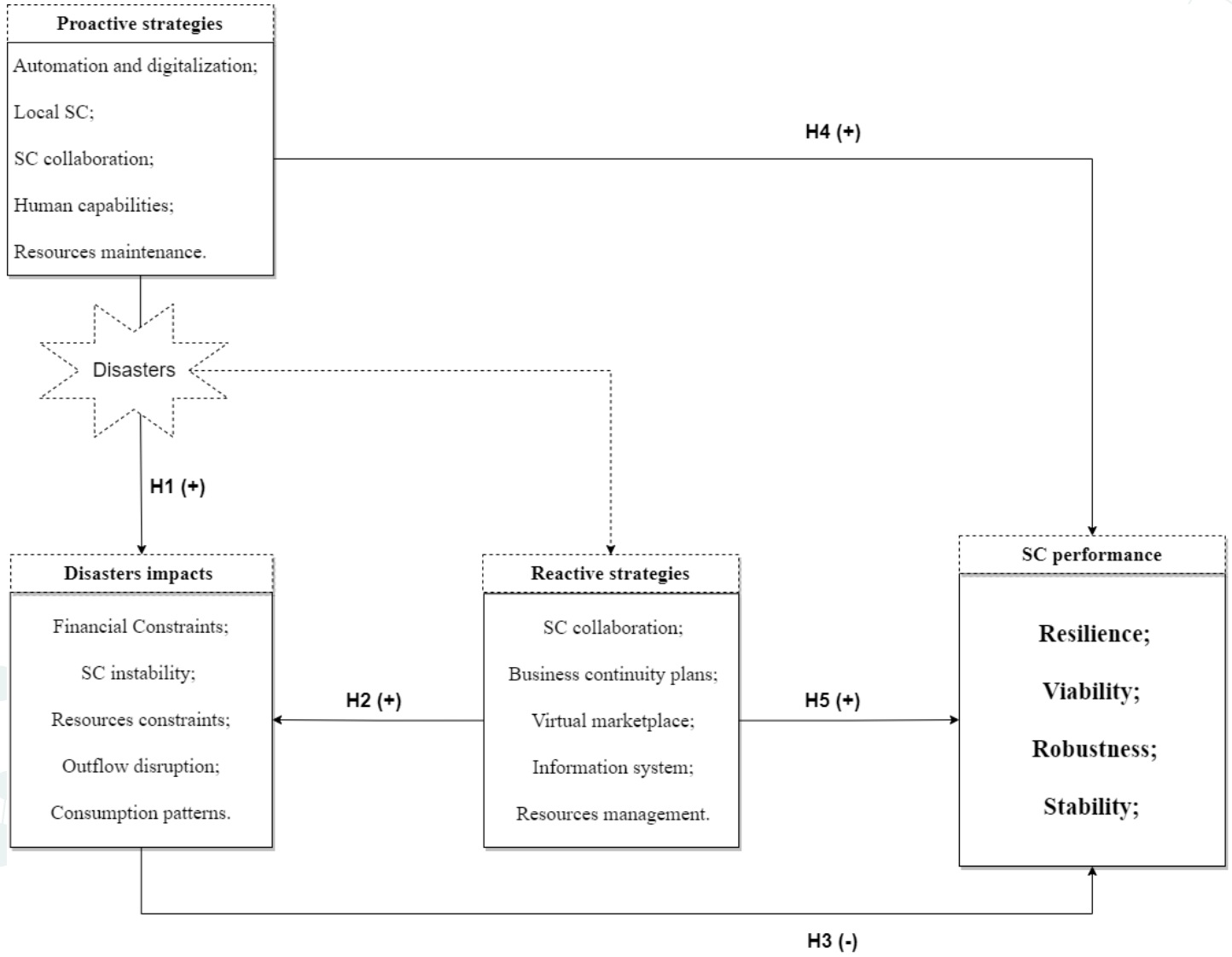
Hypotheses and framework

It is essential to emphasise that implementing proactive and reactive strategies in SCs considering the potential impacts of disasters allows the anticipation and rapid response to sudden changes caused by these events (Assaad and El-adaway, 2021). In this context, mitigating and contingency policies are important issues worthy of study (Gao et al., 2019).

H4. Supply chain performance is influenced positively by proactive strategies

H5. Supply chain performance is influenced positively by reactive strategies

Hypotheses and framework



Discussions and implications

Theoretical perspective: This study advances by considering a broader perspective, approaching not only one but several elements of supply chain performance. Still, it can also be emphasised that the study simultaneously considers the impacts and countermeasure strategies in supply chains.

Managerial perspective: the results can encourage organisations involved in SCs to implement strategies to minimise the impacts caused by disasters. Our results provide the basis for implementing the proactive and reactive strategies in the SC, as it presents specific actions related to each category.

Research agenda

The proposals are based on the main gaps identified by the RSL. They are grouped into five main topics:

(i) short-chain analysis,

(ii) cascade effect,

(iii) short-term and long-term impacts,

(iv) SC sustainability,

(v) quantitative analysis.

Conclusion and future research

- Our research contributes to a detailed list of strategies to manage disasters' impacts on SCs. Consequently, this study can support the implementation of resolving processes during disasters;

- We considered a broader perspective, approaching not only one but several elements of supply chain performance.

- Our study simultaneously considers the impacts and countermeasure strategies in supply chains and categorises this information to summarise and facilitate the presentation of the results.

Future steps:

Constructs operationalization;
Empirical studies;
Model analysis;
Lessons learned.

PAPER 3

Disasters impacts and countermeasure strategies on supply chain: an empirical study

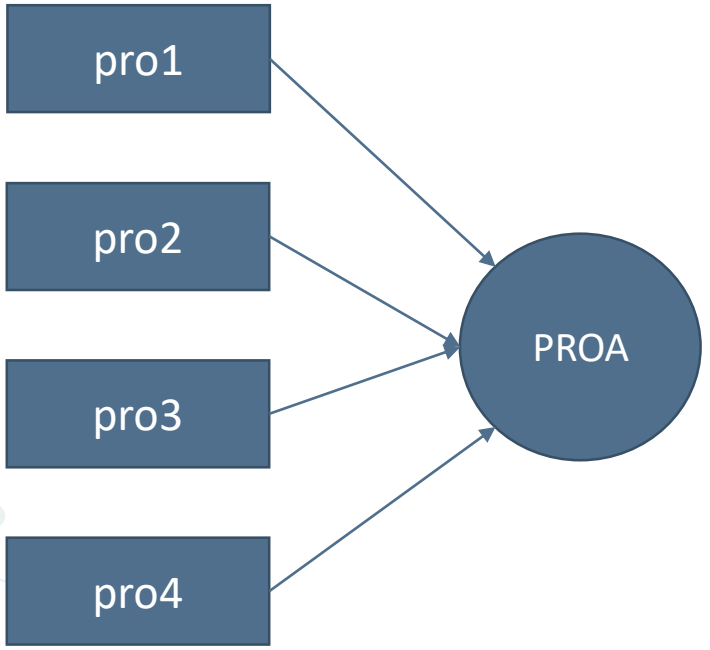
Constructos

Construct	Definition
Disasters impacts (UNISDR, 2009)	Disasters impacts cause human, material, economic and environmental losses, and damages, besides affecting the functioning of a community or society at any scale
Proactivity (Coopmans et al., 2021; Belhadi et al., 2021)	Ability to detect potential critical impacts of disasters that can adversely affect the performance of links in the SC
Reactivity (Coopmans et al., 2021; Belhadi et al., 2021)	Responsiveness reflects the ease with which actors can implement change to maintain good performance under changing circumstances
SC resilience (Scala and Lindsay, 2021)	Ability of the supply chain to be prepared for unexpected risk events, responding and quickly recovering from potential disruptions to return to its original situation or grow by moving to a new and more desirable state
SC stability (Ivanov and Dolgui, 2020)	Stability is the ability to meet the demands of surviving in a changing environment
SC Viability (Ivanov and Dolgui, 2020; Ivanov, 2020; Ivanov and Dolgui, 2021).	SC viability is the ability to meet the demands of surviving in a changing environment
SC Robustness (Ivanov and Dolgui, 2020; Ivanov, 2020; Ivanov and Dolgui, 2021).	SC robustness is the ability to withstand a disruption to maintain the planned performance

Indicators (constructos operationalization)

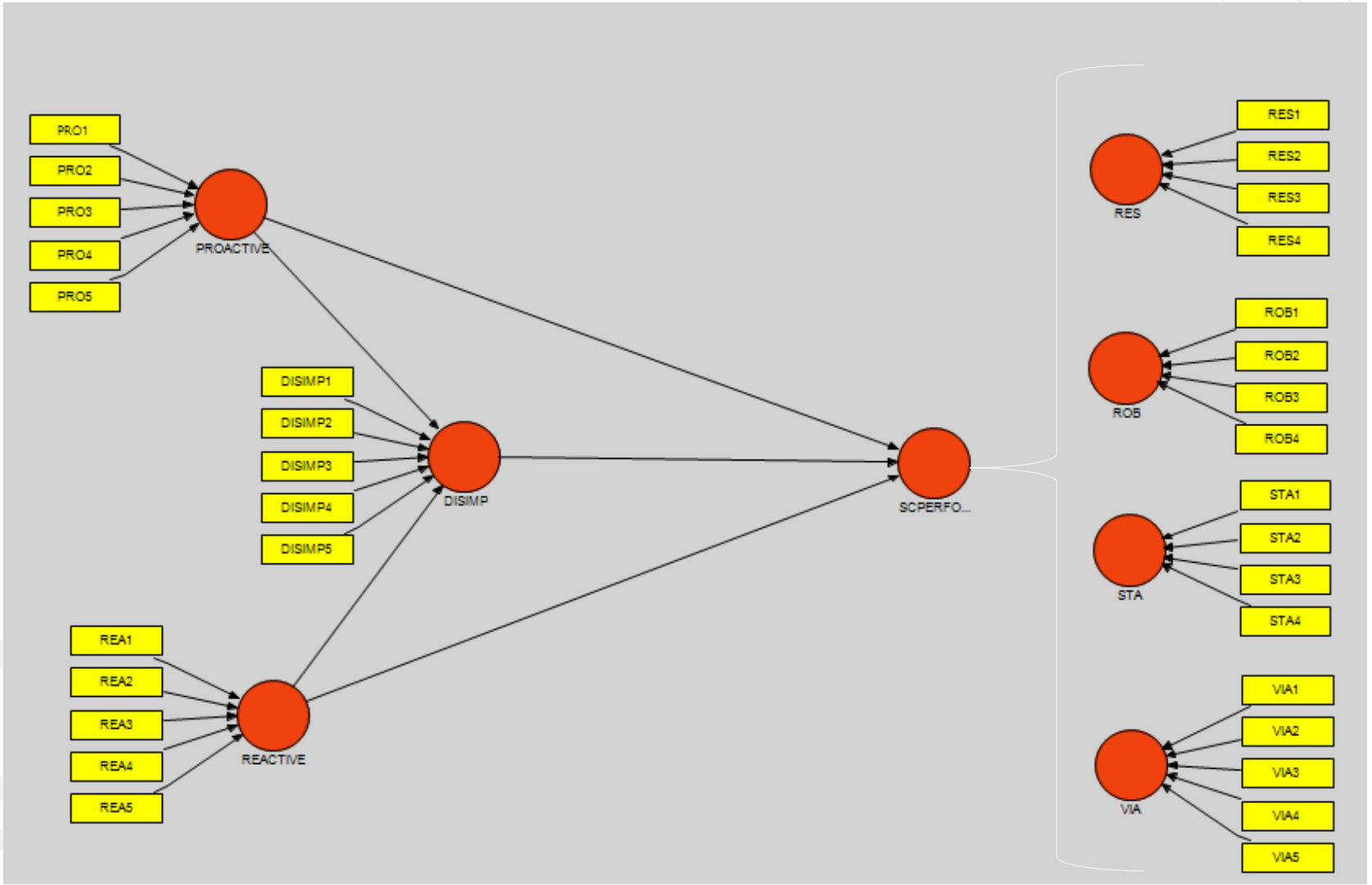
Formative constructs

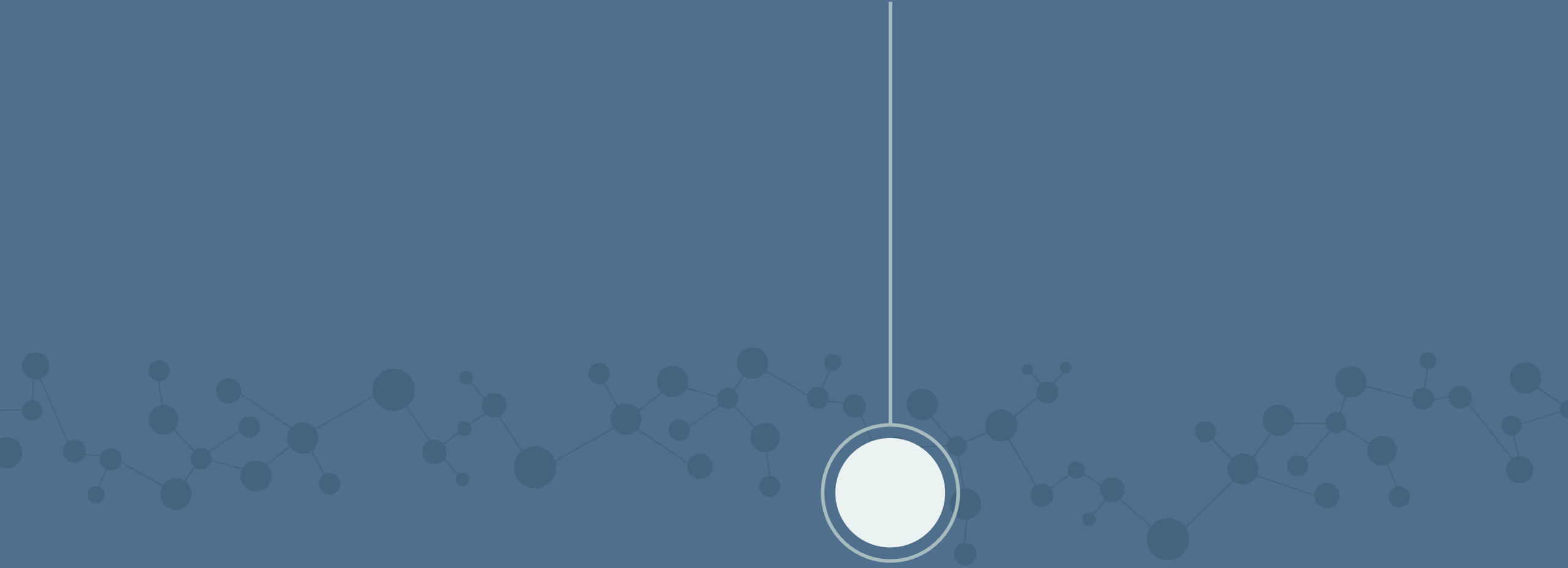
In formative constructs, latent variables are formed by manifest variables or items.



Reactivity (REA)
rea1
rea2
Proactivity (PRO)
pro1
pro2
SC Resilience (RES)
res1
res2
SC Stability (STA)
sta1
sta2
SC Viability (VIA)
via1
via2
SC Robustness (ROB)
rob1
rob2

Model (preliminary)





To be continued....