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The role of B2B digital platforms for managing future worldwide crisis. A strategic sensitivity framework for exploiting the breakthrough technological innovations

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ABSTRACT

The recent years have been dominated by the urgency of mitigating the effects of dramatic emergencies. In the first step the sudden outbreak of Covid19 and next the Ukraine conflict raising have put under stress the stability of worldwide B2B digital platforms sectors. In response to the unpredictable catastrophes the worldwide organizations started to adopt several breakthrough technologies by means of confused response strategies. The literature did not sufficiently address the issue of which could be the most effective ways to relief a crisis picking solutions from the new breakthrough innovations in B2B digital platform systems. The analysis of B2B digital platforms during a crisis is not trivial because of the system complexity. To fill the literature, gap this paper exploits the line of study of crisis theory. Through the lens of analysis of the adaptive management model, the paper aims at creating a theoretical model based on the most impactful breakthrough innovations on B2B digital platforms mechanisms. Related to dual adaptive management approaches, the study creates four different scenarios to simulate through a system dynamic method. The results of the simulation come up with four main mitigation strategy patterns associated with the different levels of crisis perturbation and adaptive approach style. The paper aims at expanding the study on B2B digital platform technological evolution and provides some interesting insights on how to configure an effective crisis mitigation strategy.

1. Introduction

The 2020s are full of extreme events that are fueling a worldwide uncertainty. The governments, the companies, private and public institutions are called to be more sensitive to these extraordinary events.

The technological knowledge has permitted to endow worldwide industries with new breakthrough technologies. For the sake of clarity, it is worth clarifying the concepts of breakthrough innovations and breakthrough technologies. According to [Ahuja and Lampert's \(2001\)](#) work technological breakthroughs should be defined as inventions that shape the development of industries by opening new paths for many subsequent technological developments. The recent work of [Capponi et al. \(2022\)](#) came up with a very clear definition of breakthrough innovations. The authors affirm that a breakthrough innovation

“significantly depart from common practices and can potentially reshape existing markets, create new markets, and prompt the emergence of new technological trajectories”.

The emergencies have pushed the organizations to come up with new and urgent solutions. Although, the technological deployment has been disaggregated and confused. The scholars have not deeply comprehended the future evolutionary trajectory of some breakthrough innovations, adoptions. The B2B digital platform is one of the most rebuilt technological objects. The abrupt and unstoppable changing paths regarding some new technologies pretend to be deeper and deeper studied.

In the middle of two different catastrophes, the Covid 19 outbreak and the Ukrainian war, we have discovered a new great potential coming from breakthrough innovations and right now we should

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understand how capitalizing this new experience. B2B digital platforms have been one of the most responsive in adopting new technologies for rapidly mitigating the impact of crises. The scholars and managers must have a strong sense of purpose and an effective capability to adapt and react instantaneously. The Covid19 outbreak has deeply damaged the stability of the most important global value chains. The lockdown has put under stress the worldwide supply chains causing unpredictable shortage of semi-finished products and raw materials. The panic generated by the healthcare emergency has attempted the efficiency of most sectors. Since the very beginning several clever solutions have appeared. The technological endowment helped in supporting a fast switching to virtual collaborations.

The study of [Bansal and Panchal \(2022\)](#) put in evidence how the organizations were compelled to integrate technology with almost every function by changing their business operations paradigm to remain competitive. The authors study the role of digital infrastructure in ensuring successful transfer of implemented training programs. On the same page the study of [Agarwal et al. \(2022\)](#) has investigated the role and the growth of AI technologies deployment during the Covid19 outbreak. The results show the most impactful technologies: the robot with artificial intelligence in patients' treatments or computer vision technologies for diagnostics purposes, machine learning algorithms for diseases detection.

Many of those solutions are bound to remain permanently and have just been integrated in the global value chains. The technological deployment and the transition to a much more digitized collaboration are two of the most interesting consequences of the Covid19 outbreak.

The massive recourse to B2B digital platform adoption and the fast transformation of entire chunks of value chains in super digitized networks ([Peruchi et al., 2022](#)) are consistent signals of some durable effects of the crisis on our economies. Once again, the Ukrainian war is providing new concrete insights of profound and intense strategic adjustment of business networks to a global crisis. The recent disasters are jeopardizing the stability of the global value chain, and the consistency of B2B relationships of actors ([De Reuver et al., 2018](#)). Taking a brief view of the actual manufacturing supply chain, the large multinational companies are going to place new agreements around the world. The deterioration of geopolitical equilibrium between western and eastern countries has mined the B2B collaboration especially for the large western corporations (i.e., Apple, Microsoft) and the biggest manufacturing Chinese plants system. Under these circumstances the new challenges claim new perspectives for analyzing the scenario, and new approaches for fighting the dramatic reinforcing of negative impacts. The sudden and catastrophic takeoff of the two dramatic events has put the world in the need of finding new and immediate investigations. The previous global crises have received a consistent attention, consequently we could pick some extant theoretical framework for interpreting and addressing the current events. The literature on disaster management and crisis management fortunately has been advancing in the direction of a systematic reading of the catastrophe ([Khodarahmi, 2009](#); [Doulgerakis et al., 2020](#)). So, we are not in the condition of completely missing one or more behavioral patterns for facing a catastrophe systematically ([Eggers, 2020](#)). Indeed, some interesting work has come up since the very beginning, and the scholars have empowered the literature with very interesting findings about B2B digital platform management and the crisis mitigation strategy management ([Cusumano et al., 2019](#)). Most of those studies have assessed specific trends, such as the negative effects of Covid19 outbreak or the most played response strategies powered by the business organizations. Unfortunately to date no studies provide an analysis for simultaneously evaluating the B2B digital platforms breakthrough innovation adoption strategies when they are solicited by a global crisis ([Cortez and Johnston, 2020](#); [Peruchi et al., 2022](#)). The literature is not still investigating the behavioral patterns in response to an external perturbation and consequently we do not know a lot of what the best breakthrough innovations adoption strategy could be ([Wu et al., 2022](#)). In this paper we

try to fill this literature gap starting from the assumption that we will achieve a deep and effective comprehension if and only if we would be able to disentangle the systemic reaction activated by a worldwide crisis. So, our research questions are: firstly, what are the most sensitive B2B digital platform technological mechanisms that are activated by a global crisis? Besides according to the mechanisms evoked in the first research questions, does there exist a breakthrough innovations adoption set of strategies up to the task of mitigating or even exploiting the crisis perturbations? For successfully replying to our research questions, we exploited three main lines of studies. The first is related to the B2B digital platforms ([Cusumano et al., 2019](#)). We scrutinized the most important papers on the topic looking for the most sensitive mechanisms that are exposed to a crisis perturbation ([Morrish and Jones, 2020](#)). The other groups of papers that we reviewed belong to the crisis management theories ([Zhang et al., 2021](#)). We leveraged the knowledge on this topic for grouping the most important systemic perturbation effects that a crisis could provoke on a network. At the end we bridged in a unique theoretical framework the concepts by the lens of analysis of the adaptive management theory ([Allen and Garmestani, 2015](#)). Once the theoretical framework has been built on solid conceptual fundamentals, we could run a simulation for getting clarity on a very complex system like the B2B digital platform is. We managed this level of complexity by exploiting a systemic dynamic model. This method permits us to simultaneously manage a great number of heterogeneous variables that seamlessly activates a great pattern of feedback loops that reinforce and balance the effects ([Williams, 2011](#)). At the end of our simulation, we provide as results a strategy matrix (see [Fig. 7](#)). The strategy matrix is framed by orienting the axis on the levels of perturbation activation mechanisms (high/low) and adaptive management approach (passive/active) that individuate four regions to efficiently apply a very fitting innovation adoption mitigation strategy.

The paper adopts a research design characterized by an approach that is principally deductive and anchored on two consistent and reinforcing methods. Indeed, for achieving a deep understanding of the B2B digital platform during a crisis we exploit a robust literature review analysis and a system dynamic simulation. To ground the analysis in previous digital platforms management studies and crisis management field, we scrutinized the extant literature for catching the most significant factors that take part in the B2B digital platform value creation. Successively, we exploit the literature legacy for strengthening our theoretical framework and creating our topology. The research process enables us to run the simulation fairly and effectively. At the end of the simulation process, drawing from the finding we create a mitigation strategy matrix. This research aims at potentiating the knowledge about the B2B digital platform transition. In other words, we would like to provide some new insights about what could change when a crisis occurs and eventually which style of digital transformation strategy to adopt. We try to contribute to the fields of Digital platform study by adopting a systemic perspective, by providing four main digital transformation strategies.

2. Theoretical background

2.1. The impact of breakthrough innovations on B2B digital platforms mechanisms

[Rohm et al. \(2004\)](#) have described the B2B digital platform as "an inter-organizational information system through which multiple buyers and sellers interact electronically to identify potential trading partners, select them and execute transactions".

B2B digital platforms are fundamentally internet-based aggregators, they act as virtual places buyers and sellers get deals ([De Reuver et al., 2018](#)). Hence, one of the most important features is the role of intermediary, playing for boosting the transactions among the actors that join the platform. Value sharing is another consistent trait for defining a B2B digital platform. In other terms the platform should not only sustain the

network among parties that otherwise do not have rooms for meeting, but also boost the exchange of value alongside information (Peruchi et al., 2022). The perspective of Peruchi et al. (2022) enlarges the clarity on the theme of B2B platform. Indeed, the authors specify that the B2B nature of whatever business network, digital or not, lies on the exchange and innovation among the participants representing multiple people and companies. Furthermore, the work affirms that the B2B network is not a scientific object observable from a one company's perspective but from the overall system (Zhang et al., 2021). The authors give a warning in not adopting an individualistic perspective. Any interpretation from a partial perspective might be misleading and limited, especially when we are making a comparison concerning the functionally and the mechanisms of the entire network. Getting good transactions among actors is necessary in any platform, but insufficient for consistent and stable success over the time (Wu et al., 2022). Creating solid relationships and efficient tides in the platform's environment requires a high sky level of trust. Otherwise, running a digital platform with a lack of trust needs of players that make a leap of faith every time (Cusumano et al., 2019).

If we consider the context, B2B digital platforms have a point of difference in comparison to the traditional virtual platform. Indeed, a B2B digital platform is participated by business organizations that have the main interest of improving their own performances. B2B digital platforms allow participating actors to exploit a bunch of advantages. According to Rodríguez and Giraldo (2011) the spectrum of advantages is formed by: professional experience, knowledge exchange, opportunities to innovate, availability of sales and supplier information. This list of fruitful activities is not sufficient for a complete definition of a B2B platform, in fact the activities must be coherently aligned among them with significant scale impacts (Cortez and Johnston, 2020; Peruchi et al., 2022).

So, according to extant studies the exchange of value is conceived as economic shared value. The B2B digital platform actors aim at exploiting the infrastructure connection, for achieving more economic value, it must not be conceived only under the financial perspective but more generally as capacity to generate more value in terms of innovation capacity, problem solving capability, market adaptation sensitivity (Cusumano et al., 2019). The technological architecture is another paramount feature for giving a fair understandable B2B digital platform definition. (Liu et al., 2020; Su et al., 2021). The technology plays a crucial role in enabling several functions for connecting actors faster and faster (Cortez and Johnston, 2020; Peruchi et al., 2022). The technology as concept is a very broad meaning that must be deeper addressed for a fully understanding of B2B digital platforms. The previous studies point out the concept of technology readiness as a predominant factor in technological analysis of B2B platforms (Islam et al., 2020; Vize et al., 2013). Specifically, the technology readiness depicts the ability of a business organization in adopting specific technological solutions that improves the exploitability of digital platforms. The literature review of Shree et al. (2021) contributes to disentangling the abstractness. The authors go in depth providing the major impactful factors on the technology readiness level (Su et al., 2021). The level of industry trust is a significant factor in generating high propensity levels in joining and exploiting a digital platform. The second factors the organizational context, technology readiness has emerged as a significant factor. Technology readiness reflects the organization's interest and ability in embracing and adopting innovative technology. The technology readiness of an organization is shaped by factors such as the level of industry trust, past (in)experience and switching cost as the uncertainty related to the digital platforms is still widely prevalent.

A B2B digital platform is a virtual place where several actors take interactions among them. B2B digital platforms are participative infrastructure based on four main features: infrastructure components, that basically correspond to the hardware, software and service systems; governance rules components, that can be defined as the bunch of standards, protocols, policies and contracts set for running the platform interaction efficiently; user groups that are formed by the platform

actors that join the interface and exploit the platform potential and the platform orchestrator that could be defined as one or more institution focused on making platform maintenance, updating and development. The platform orchestrator is not a trivial point; indeed, the platform orchestrator oversees several functions, that most of the time are not concentrated in a unique institution. Penttinen et al. (2018) have provided a very understandable concept of platform orchestrator by individuating two distinct institutions: platform owner and platform provider.

The traditional value chain, that has a linear shape, is not comparable to the network anchored to a B2B digital platform. The digital platforms boost a different way for creating and delivering value. The interactions are the core factor at the base of a conjointly system for improving the value proposition. The process is run as a multi-sided system. The abandonment of bilateral relationships in favor of a multi actors logic fosters the value creation, and the appropriation logics differ from the traditional pipeline businesses. The changes are enabled by a higher level of range, speed, reach and responsiveness of a platform. The impact on cost cutting is not trivial, the actors can improve their financial performance because of joining a B2B digital platform.

2.2. The crisis management theory: some insights for interpreting a digital platform network

According to Gabrielli et al. (2019) a systemic crisis is an event with a very low chance to be predicted, with a large widespread magnitude of consequences and non under control repercussions at several levels. The field of study crisis management together with disaster management and catastrophe management has conducted a large investigation on different kinds of crises. The crisis context and its peculiarities are fundamental, without taking care of the catastrophe specificities there is no room for an effective analysis of the crisis (Khodarahmi, 2009). Hence in the last decades the natural disasters such as hurricanes or earthquakes have taken large attention. Most of those events habitually take place on a large scale that has, in most of the cases, a restricted territorially reach. Cortez and Johnston (2020) in a work on the analysis of the effects of Coronavirus outbreak in B2B settings have highlighted significant differences between a catastrophe as a pandemic emergency and the global financial crises (Karim, 2011). An interesting takeaway for our research is the formation and the propagation causal loops of the effects. In the case of Coronavirus, the damage spreading impacts firstly on the individual getting in the following phase a classical snowball effect (Karim, 2011). Quite the opposite, a financial crisis fires up firstly at a systemic level for affecting the individuals later. So, the authors theorized that economic/financial crises generate a systemic type of behavioral patterns, otherwise socio-biological crises open the route to individualistic behavioral response patterns (Su et al., 2018).

The diffusion of Covid 19 has forced the scholars to adopt a game changer perspective. Indeed, the outbreak has been a plot twist in crisis management (Grewal and Tansuhaj, 2001). This dramatic and unexpected event has impacted at worldwide level as previous financial crises but with no change to apply the same mitigation strategies. At the time of the outbreak the scholars have immediately fired up the investigations for coming up with response strategies (Estuar et al., 2017). The lockdown has put in sufferance the value chain around the world. The shortage of supply chains has hindered the distribution of products globally. All the manufacturing industries have stopped their assembly lines. Other industries have got interesting new solutions by adopting virtual technologies.

The literature concerning strategic management has deeply addressed the issue of crisis effects mitigation. The urgency in creating an effective response strategy is necessary (Galindo and Batta, 2013). Several studies have consistently figured out the consequences of worldwide crises. The majority of B2B studies concerning crisis effects have put under the lens of analysis the value chain performance perturbation. The study of Angeletos and Werning (2006) have

addressed the issue of volatility and the role of endogenous and exogenous information that play a crucial role in destabilizing the business networks. The authors have provided a great contribution in understanding the unexpected and sudden changes of systemic conditions such as partner reliability, network effect assessment or technology innovation adoption (Su et al., 2021). The study of Powell-Jackson et al. (2018) provides important insight about the focalization of people's capacity of pursuing assigned tasks during a global catastrophe (Morrish and Jones, 2020). The study provides some clarity throughout an interesting behavioral pattern that comes up when a global crisis takes off. Prior to Covid19 and Ukraine crisis, a couple of studies (Cropanzano and Mitchell, 2005) based on previous catastrophes have come up with interesting insights on the relational imbalance due to the crisis.

The extant literature on crisis management has a huge lack in bridging the knowledge coming from organizational risk assessment studies and the outcomes provided by the disaster manager studies (Doulgerakis et al., 2020). To date we have extended analyses concerning the way you could examine the impact of a crisis and at the same time a huge bunch of strategies that could be adopted in case of a disaster. Unfortunately, we have no sufficient comprehension on what strategy might better fit to a specific set of catastrophe risks. Garner (2017) specifies that crises abruptly fire up, need new and untested behavior under time constraints. The work of Cortez and Johnston (2020) is on the same page, the authors, indeed state that "the ability of organizations to assemble the necessary resources immediately is critical. When the pattern of ties and the need of coordination overlap, greater resources can be made available". This work sounds as a pioneering study, opening a new route towards an agile response to the systemic crisis.

3. Research model: Building a B2B digital platforms sensitivity theoretical framework, the adaptive management model to decodify the role of breakthrough innovations during a crisis

The Covid 19 and Ukraine War has put under stress the worldwide value chains. The sudden and unpredictable events have created urgency in providing new and consistent knowledge for business organization relief. For addressing our research goal and fairly running a reliable scenario simulation we needed to come up with a consistent theoretical model that adherently captures the model evolution when a global crisis fires up (Eggers, 2020). The Complex systems in a very dynamic environment are far to be understandable, especially when a catastrophe undermines the network stability. Hence, in this paper the issue of crisis effects is not conceived as an external event that generates a bunch of consequences. Otherwise, this investigation aims at looking for the mechanisms and behavioral patterns generated by an external catastrophic event that takes part in a B2B digital platform evolution (Shree et al., 2021). Our model needs to exploit a lens of analysis that permits us to directly observe the system changes when an individual actor deflects from the previous strategy (Williams, 2011). Each business organization experiences a kind of uncertainty when a crisis suddenly hits the global system. In this perspective, our theoretical model has been crafted drawing from the line of studies of adaptive management. The literature on the crisis events, as reviewed above, has come up with several interesting findings concerning the catastrophe effects but not so much about the capacity to adapt over the negative and extreme external events. The adaptive management permits us to undertake our research by exploiting a framework that facilitates learning-based decision making (Williams, 2011). The adaptive management framework is described as improving through adjustments by absorbing and incorporating the external impacts. The adaptive management framework fits on all the systemic changes that occur when the system is exposed to an external perturbation. The framework improves the comprehension of how the behavioral patterns of each system entity start to change. In this paper we exploit the work of Williams (2011) that has developed an updating model by recognizing two different styles of

adaptation: a passive adaptive way and an active adaptive way (Williams, 2011; Allen and Garmestani, 2015). The author's bottom line is that adaptive management is an objective-driven decision making through time with management actions at a given decision point that are updated according to specific levels of systematic uncertainty (Byron, 2011). The adjectives passive and active are two of the most misleading words for discerning and prompting a concept full of clarity. For not taking this risk, this paper associates the terms passive and adaptive to the behavioral response in addressing the uncertainty. From this angle the adaptive framework overlaps the concept of perceiving the uncertainty, very common for the financial studies (Williams, 2011). Although the adaptive management study provides a higher level of clarity, specifically in recognizing a very deep impact on the behavioral patterns (McFadden et al., 2011). Byron's model is a three-level scale (early, late, none) of adaptive management action that captures the responsiveness of an entity in decodifying the genesis of the uncertainty. The adaptive management framework has another interesting variable that is the learning capability (Zia et al., 2023). In a nutshell, the learning capability might be expressed as the ability in reducing the level of uncertainty about the effect of drawdown timing. In our model we assume that a passive adaptive way corresponds to a late or none decodification of uncertainty, that generates no learning processes. To the other hand, an active adaptive way is referable to an early-stage uncertainty facing and an abrupt activation of learning processes (Allen and Garmestani, 2015).

Drawing from the B2B digital platform literature, we have crafted a theoretical model aggregating all those variables that play a role in B2B digital platform functionality. Hence our model reproduces a B2B digital platform network. We exclude all the factors that have no real ties with a business vocation platform (McFadden et al., 2011). Our theoretical formulation reflects the lack of literature, we accept the discrepancy among digital platform context, business value chain and crisis external events. Our literature overview has provided significant evidence that the scholars have addressed the issue but without bridging dynamically and simultaneously the three issues (Williams, 2011). So, the work of Cortez et al. (2022) provides significant takeaways concerning the way a healthcare catastrophe might affect the B2B industries around the world. In our research we adopt the same lens of analysis for investigating the impact of a global crisis on the B2B digital platforms. According to the authors Cortez et al. (2022), we have depicted a theoretical model that shapes the value chain mechanisms as social exchange theory driven. It means that an actor joins a B2B digital platform with the expectation to obtain a net positive value. In other terms the net value shared among the business organization in a digital platform plays the role of aggregator power (Krings et al., 2021). Thus, the conditions permit us to consistently craft the behavioral pattern of business actors of B2B digital networks (Su et al., 2018). For the sake of clarity our theoretical model might be conceived in three conceptual blocks (Estuar et al., 2017). Each theoretical level comes with its aggregate variables. This operative level of analysis is formulated based on insight derived from the literature scrutinizing process. The analysis of extant empirical works permits us to come up with quali/quantitative levels of the aggregate variables. The first block of analysis concerning the crisis management theory. The aggregate variables are formed by several three main perturbation mechanisms: partner reliability, network effect assessment and technology deployment. This aggregation run for increasing the simplicity without losing consistency, is basically a grouping operationalization of the most studied mechanisms that are subject to significant impact during a crisis. The empirical studies have demonstrated that the impacts on the mechanisms might be put on a high/low intensity scale to facilitate the comprehension. The second block of theory concerning specifically the B2B digital platform. Our model, applying the same approach of Cortez et al. (2022) that considers the crisis propagation direction from individual to the system, identifies three main perturbation targets that are the aggregate variable: platform owner, digital interface, and platform orchestrator. According to the

extant studies on the B2B digital platforms, the level of those aggregate variables concerns the degree of exposure to the crisis of each actor. The last theoretical block is the adaptive management theory (McFadden et al., 2011). The behavioral model enables us to come up with two different styles of adaptation: a passive adaptive way and active passive way depending on the level of responsiveness to the uncertainty and the learning process capacity (see Fig. 1). The sensitivity theoretical framework provides four different case categories according to high/low levels of perturbation and passive/active adaption styles. Crossing the four cases we can simulate all the possible scenarios for a B2B digital platform network (see Fig. 1).

4. Methodology: system dynamic simulation

Even though optimization and analytical models are dominating quantitative modeling in digital platforms studies and crisis management studies, recent literature suggests that SD modeling is constantly coming up in the last couple of years (Rebs et al., 2019). Besides, research on digital platforms is shown to be an emerging field, while System dynamics modeling has not been used to investigate the issue of crisis perturbation and B2B digital platforms. The System dynamic model is particularly indicated in all those cases where the heterogeneity and complexity are elevated, and the variables are driven by a high degree of causality.

The causal loop diagram is used by the authors, because of its extraordinary capacity for representing the feedback structure of the under observed system (Sterman, 2010). The research design is run by capturing the all-round system mechanisms. Long used in academic production, the causal loops are reliable and consistent for instantaneously analyzing the hypotheses about causality phenomena and clearly communicating the important feedback to issue pioneers, practitioners and whom of problem concern (Richardson and Otto, 2008; Otto, 2008).

Specifically, this research selected the System Dynamics simulation

for capturing the changes in innovation adoption strategy and understanding the causal effects of a crisis perturbation on a B2B Digital Platform. According to the work of Dangelico et al. (2010) the system Dynamics model is extremely effective for catching changes in behavioral patterns. Indeed, Dangelico et al. (2010) affirms: “system dynamics deals with the time-dependent behavior of managed systems with the aim of describing the system and understanding, through qualitative and quantitative models, how information feedback governs its behavior, and designing robust information feedback structures and control policies through simulation and optimization.” Pursuing the research aim, this paper adopts the Dynamic modelization to successfully deal with the extreme causality of a B2B digital platform transformation during a crisis perturbation. Furthermore, The System Dynamics model permits to control the evolutionary trajectory of variables’ behaviors.

The model was run by Vensim software. The model consists of approximately 22 variables, many of which are arrays representing different B2B digital platforms complements and mechanisms that are perturbed by a crisis (see Appendix 1). We simulated several circular feedbacks generated by the interconnection of variables by processing the arrays (Größler et al., 2008).

4.1. Setting a system dynamic simulation of B2B digital platform affected by a crisis

Our theoretical speculations, deliver four kinds of B2B digital platforms scenarios to simulate. For the sake of clarity, we have created some trend indicator that in the model we called aggregate variables. They simplified and captured much more sub variables changes but conceptually belong to the same category and would be a consistent parameter for macro aggregate variables. The spectrum of perturbation mechanisms formed by Partnership reliability, Network effect assessment and technology availability has no direct effects on the platform owner, digital interface, and platform orchestrator. In our system dynamics model we could manage a much greater level of complexity, so

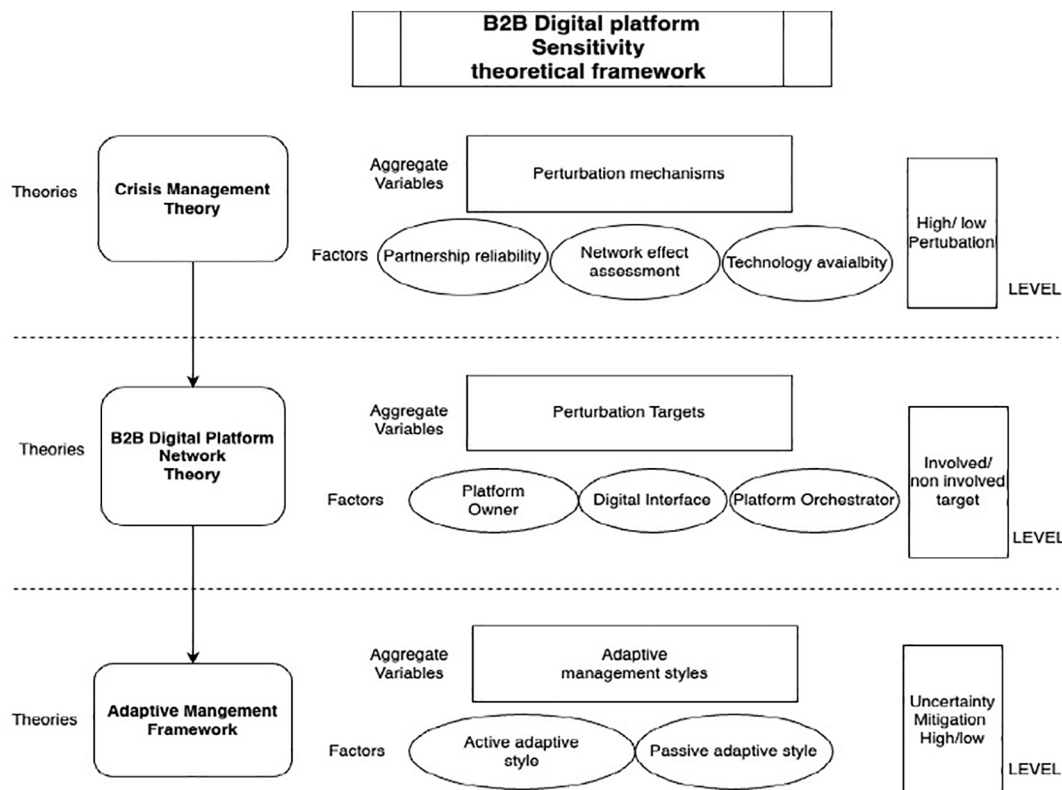


Fig. 1. B2B digital platform sensitivity model.

we could specify per each group of perturbation targets the most impactful digital platforms tangible and intangible complements. According to the early-stage literature review process, the complements act substantially as tunnels through the crisis perturbation spread up to take part into the value generation process. The Fig. 2 shows the crisis propagation passing through the complements for reaching and affecting the core of B2B platforms. The complements activated by partner reliability are reach, total cost and usability. They impact the interface by mediating a generic group of users called A that represent a chunk of a value chain. The complements activated by network effect assessment affect the platform owner and propagate the effects towards a generic users group called B that represent another step of the value chain. The complements activated by technology availability are protocols, standards and policies and impact on a user group called C that belong to another part of the same generic value chain. Besides, we run the simulation to exploit the system dynamic perspective because of its capacity to simultaneously a huge spectrum of feedback. Thanks to the software Vensim DSS version 9.3.4 we could set the reinforcing and balancing effects for creating a real-based simulation.

To experiment with the four cases characterized by the two double levels parameters (adaptive approach: passive/active; perturbation activation mechanisms: low/high), we run four different simulations. To give comparability, we normalized the functional values and fixed the same simulation time (100 months).

5. Findings

The first setting configuration run by a high level of mechanisms

perturbation and active adaptive management approach provides interesting results. As shown in Fig. 3 when the system is exposed to a great level of global perturbation the values generated by B2B digital platform, Interface, Platform orchestrator and platform provider are hit by the large exposure. The adaptive approach requests a long time to succeed. The Fig. 4 represents the results with a high level of perturbation and passive adaptive approach. One of the most interesting insights compared to the previous setting, is the effect of adopting a very locked approach. At the very beginning this approach shows some advantages by protecting the value generation. Although the digital platform seems to lose attractiveness, it is demonstrated by the abandon rate that increases along the time. The value of interface falls in the negative zone, it means that the technological impoverishment starts to provoke some damages. The platform orchestrator and the platform provider keep producing increasing value. The Fig. 5 shows the results coming from the simulation with low level of perturbation mechanisms and adaptive approach. In that case we have two very different value evolution trajectories. Indeed, for the B2B digital platform and the digital interface, the adaptive approach seems to lead at the same results of a high level of perturbation. In fact, the value seems to increase even greater than the value in Fig. 3. These results are provoked by the attitude to be super responsive, hence at the first signal of perturbation the digital platform starts to fastly change. In the long run this attitude has great success by reaching sky high value for both the components. The platform orchestrator and platform provider values differ too much compared to the analysis elaborated in Fig. 3. In this case the adaptive approach does not generate significant increase but avoids an asymptotic zero value for the starting period. The last simulation is shown in

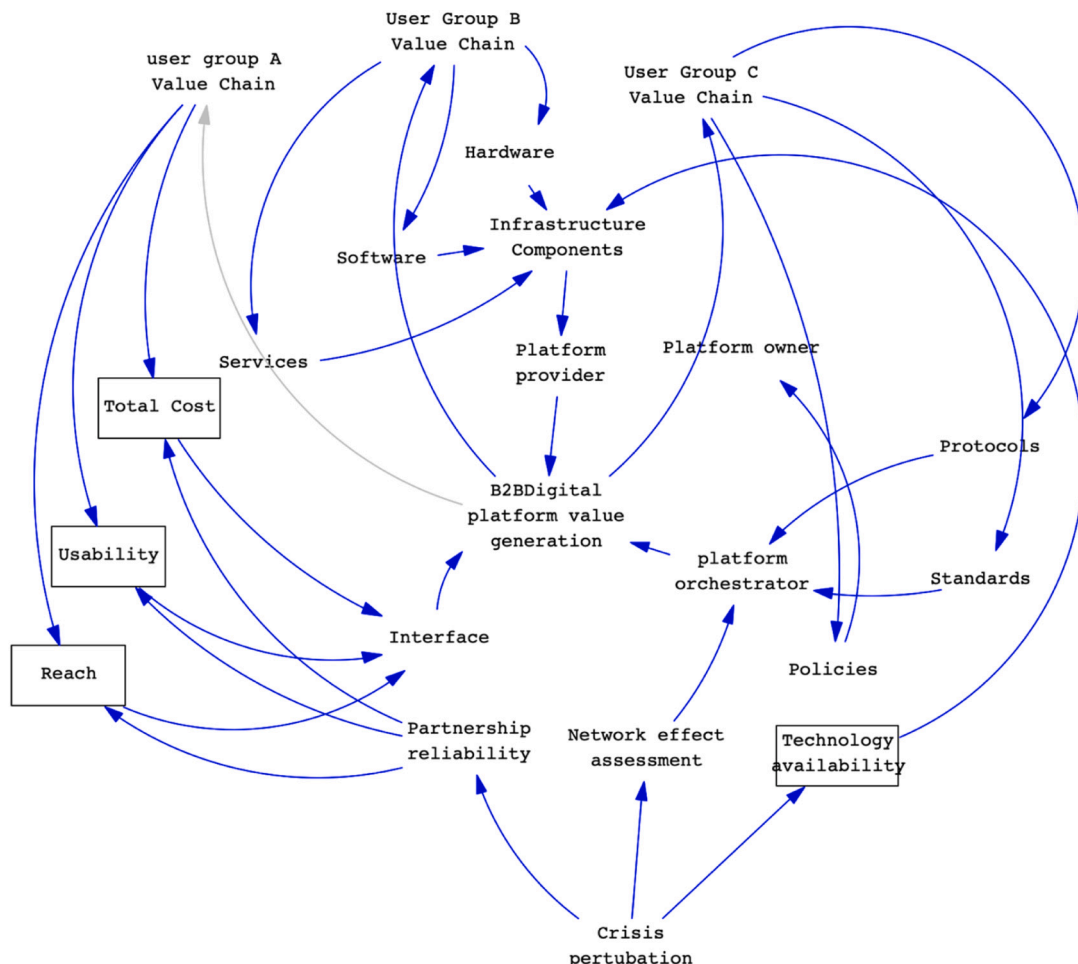


Fig. 2. System dynamic simulation of B2B digital platform.

B2BDigital platform value generation

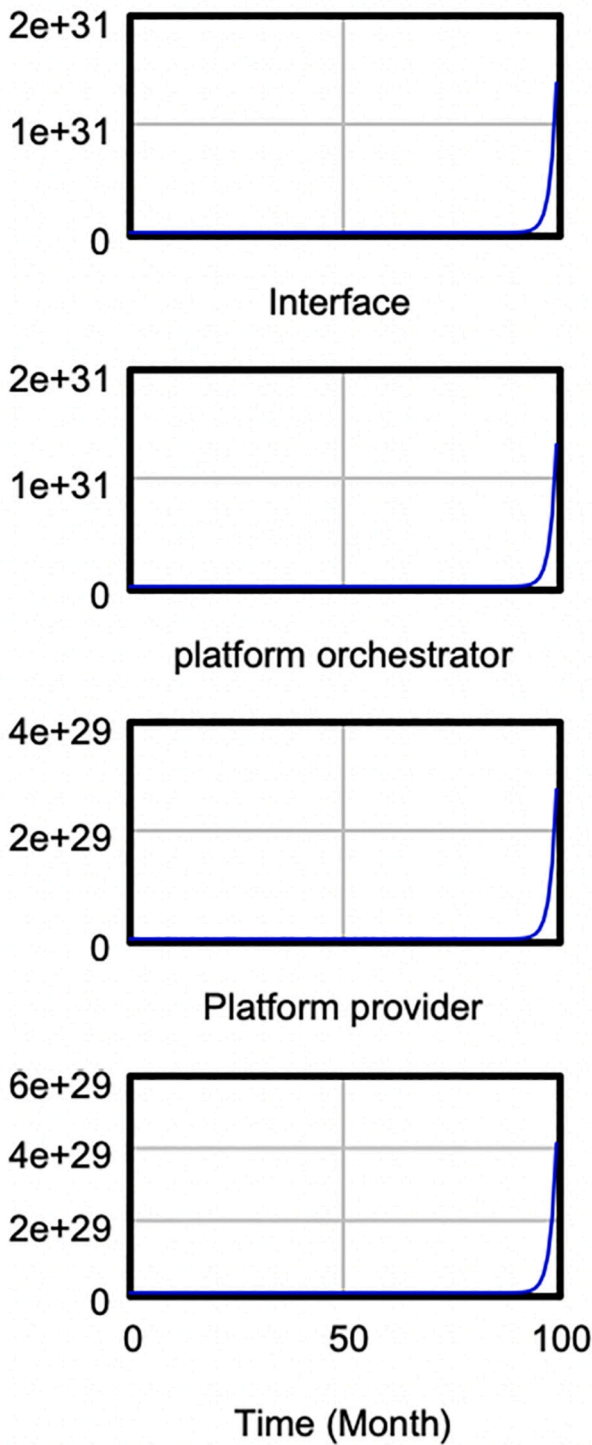


Fig. 3. Results. Simulation with high level of mechanisms perturbation and active adaptive approach.

Fig. 6, it is run by a low level of perturbation mechanisms and passive approach. This scenario captures very smooth changes of values. All four components produce positive values, but none of them is significantly grown.

B2BDigital platform value generation

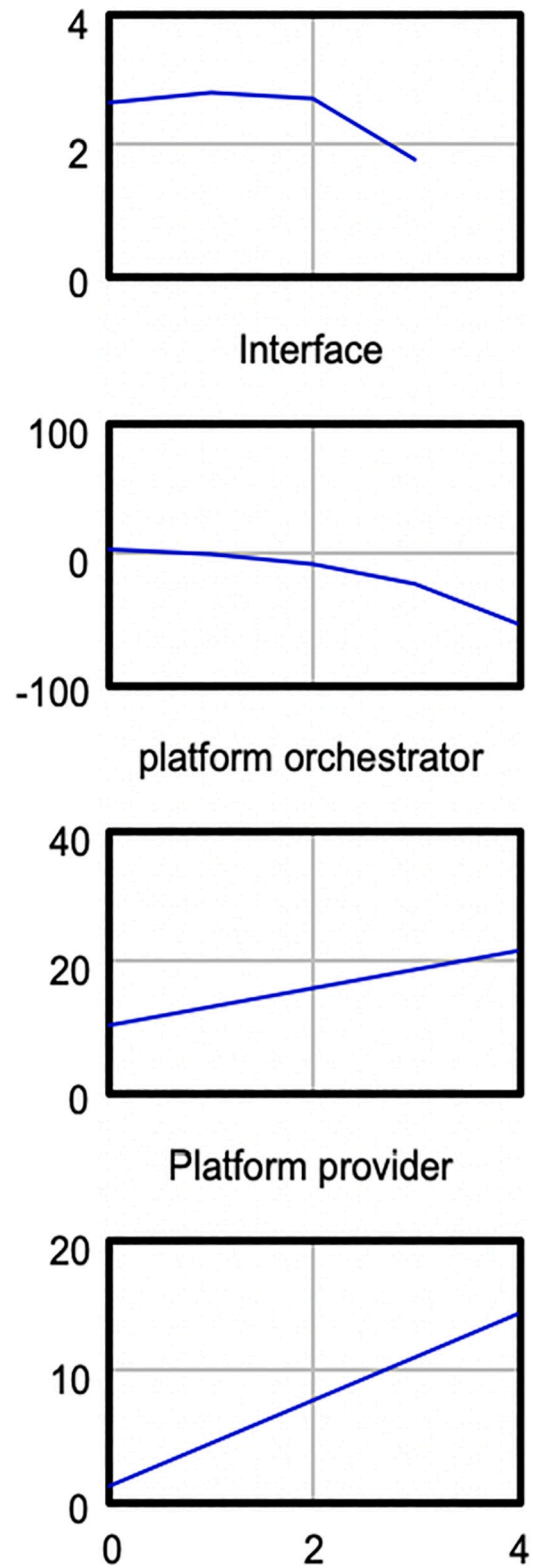
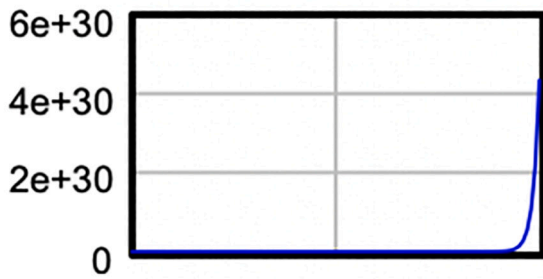
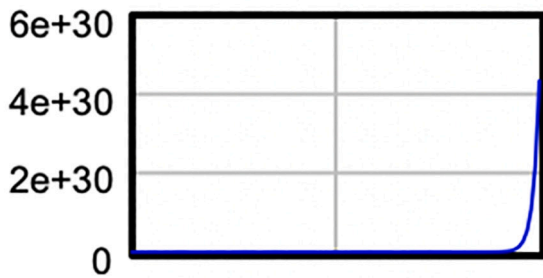


Fig. 4. Results. Simulation with a high level of perturbation and passive adaptive approach.

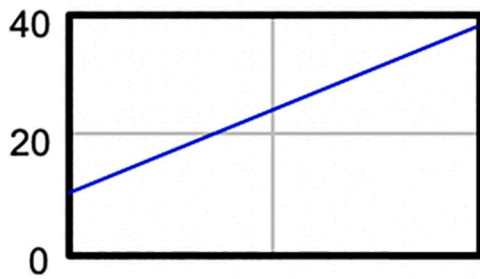
B2BDigital platform value generation



Interface



platform orchestrator



Platform provider

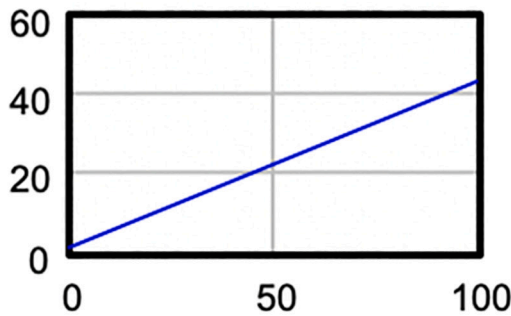
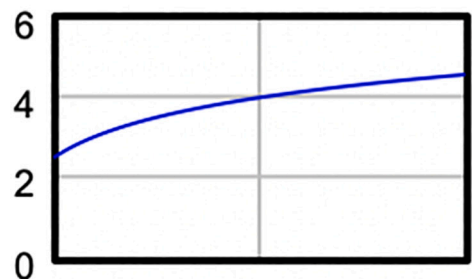


Fig. 5. Results. Simulation with low level of perturbation mechanisms and active adaptive approach.

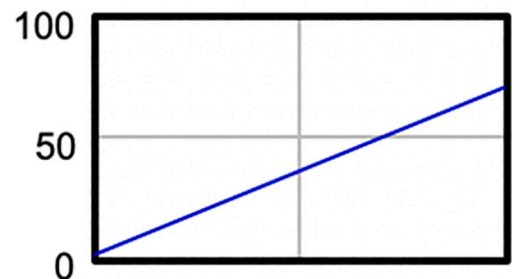
6. Discussions

To date, the B2B digital platforms and breakthrough innovation adoption are two of the most debated and investigated issues in their respective fields of studies (Capponi et al., 2022). The crises that affected the worldwide economies have pushed the scholars in shifting the perspective of analysis. The sudden and unexpected changes boosted

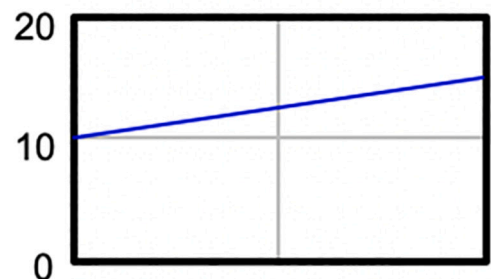
B2BDigital platform value generation



Interface



platform orchestrator



Platform provider

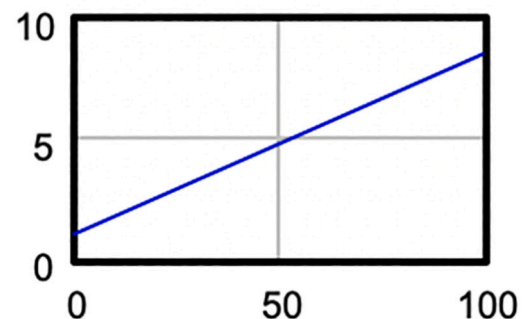


Fig. 6. Results. Simulation with high level of perturbation mechanisms and passive adaptive approach.

some phenomenon and stopped other ones (Agarwal et al., 2022). Those new conditions have provided an interesting testbed for capturing new trends about breakthrough innovations adoption from B2B digital platforms systems.

The recent catastrophes are fueling the need of urgently coming up with new knowledge for addressing those new challenges. The trickiest level of investigation is the complexity that affects our topic because it is

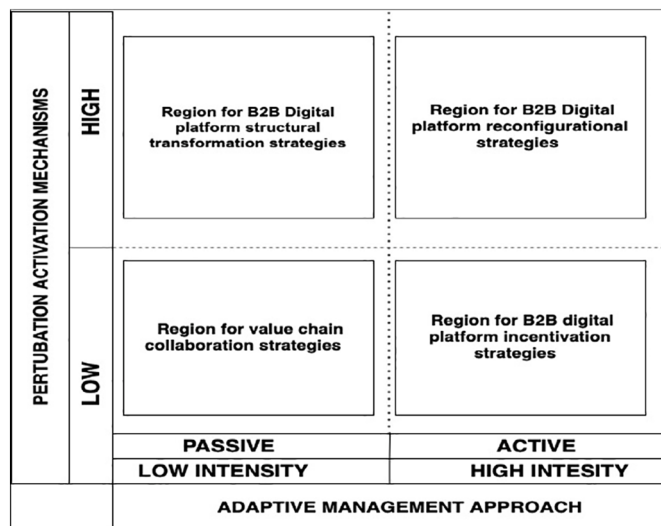


Fig. 7. Response strategies matrix.

quite hard managing simultaneously that high quantity of variables. For addressing our research goal, we crafted a theoretical model that tries to group the variables by creating aggregate ones (Su et al., 2018). Following this approach, we have been able to quantitatively catch three main variations: the intensity of perturbation and its impact on the platform mechanisms; the capacity to deal with uncertainty and adapt the strategy; the variation of value generated by digital platform, interface, orchestrator provider and orchestrator owner.

The crisis perturbation impacts on the digital transformation strategy implementation. According to the work of Correani et al. (2020) the digital transformation strategy formulation might not be followed by a coherent strategy implementation. This research expands the knowledge about this misalignment when an external crisis occurs. The extant studies provide a very complete understanding of the main factors of a digital transformation strategy. Correani et al.'s (2020) work deeply investigates the need to have clear goals for successfully setting a digital strategy transformation. Our research tries to understand how the goal of mitigating a crisis perturbation could impact on the digital transformation strategy. The Digital transformation strategy needs to clearly assess the data source, the digital platform features, the people, the partners, the AI technologies, information and knowledge, process and procedures and tasks and services (Correani et al., 2020). Accordingly, we merged and synthesized these groups of variables in order to understand the systemic digital transformation after a crisis perturbation.

To face our second research question, we create a sensitivity breakthrough innovations adoption strategy matrix. The strategic tool is useful for easily figuring out four main regions of application. Each strategic region corresponds to a specific trend that comes up from the simulation. The strategic region should reinforce the knowledge concerning the most efficient response strategy to adopt for mitigating a crisis in a B2B digital platform network (Peruchi et al., 2022). We run a comparison between the four scenarios to understand what the most effective response strategy under specific conditions could be exploited when a breakthrough innovation is adopted by a B2B digital platform. The findings provide interesting insights especially when we boil down on the adaptive approach matrix. Mainly focusing on the two simulations that have active adaptive style, we could affirm that no significant value changes appear among the case of high and low perturbation for the B2B digital platform and interface (Garner, 2017). Consequently, for these two components there are no rational reasons for taking a passive adaptive approach. Although the intensity of variation in value creation of platform orchestrator and platform owner deeply differs between the cases of high and low perturbation. Keeping the perspective of these two components actors the users could prefer during a crisis takeoff taking a

passive adaptive style (Morrish and Jones, 2020). Especially if they do not care about a long-term orientation, actors belonging to these two components might keep a very opportunistic behavior by hindering the network changes. Under these circumstances our work suggests implementing reconfiguration strategies in the matrix region with high perturbation and active adaptive approach (Liu et al., 2020). In the matrix region with low perturbation strategies and active adaptive approach the results indicate as best response strategies a B2B digital platform incentivization strategies strategy. For implementing strategies of collaboration and value sharing. The actors belonging to the first two groups should activate some incentivizing strategy for reducing the opportunistic behaviors.

The digital transformation strategy is based on the need to be innovative and refresh the digitalization evolution pattern of a company. Adopting new technologies does not automatically produce a growth of innovative capabilities (Usai et al., 2021). Our research comes up with four main strategic style patterns that could support the digital transition, specifically our findings provide some insights about the adaptation. A low passive or active adaptive approach might play a crucial road towards a successful digital transformation. Some of the digital platform mechanisms touched by crisis perturbations are activated even during a digital transformation strategy. Accordingly, the four regions of strategic matrix might play a role in anticipating and governing the digital transition.

Analyzing the condition of passive adaptive approach, the results suggest that when a crisis intensity perturbs the systems the passive style is the worst scenario for all the component actors (Penttinen et al., 2018). For the entire value chain there are no possibilities for facing the crisis and the value generation process is on the way to decrease even to reach a negative value for the interface: This matrix region is good for the adoption of B2B structural transformation strategies. Although for the platform orchestrator and the platform owner it remains the strategy to be passive and opportunistic. Indeed, comparing the simulation with high and low perturbation they might decide to remain passive. This risk is even greater when the actors do not know very well the intensity and the evolution of perturbation. In fact, under the circumstance of asymmetric information the user of the orchestrator and owner might decide to be stuck in the middle for observing the evolution. It is a very common response strategy that happened during the Covid19 when most worldwide business organizations had no understanding, and consequently they have remained at observing the crisis evolution with no mitigation strategies to implement (Karim, 2011). In conclusion if the area characterized by high perturbation level and passive adaptive approach is easy to define as a failure strategy region, we should remark once more that a passive adaptive approach might be tricky under the circumstance of low perturbation. Some actors could not be worried of crisis risk and put the entire system in danger (Del Vecchio et al., 2018). This matrix region is indicated for implementing some B2B digital platform compensatory strategies.

7. Conclusions

The severity of effects generated by the last two worldwide crises, the Covid 19 and Ukraine war have destabilized the global economy. All the industries around the world have been affected by a sky-high level of uncertainty. The value chains are pushed to reconfigure their structures and find new mitigation strategies. We observed several signals of the perturbation that are storming the business networks worldwide and forcing change in the shape of the value chains. The mushrooming of factories in southern India is a considerable signal of the emergence of a new global value chain, with new players. After the Ukraine conflict explosion, the geopolitical instability is forcing the most important western player towards an abrupt decoupling of value chains. Since the Covid outbreak, other signals have emerged. (Peruchi et al., 2022). The shortage of some raw materials has put under stress most of the economies. In certain cases, some opportunities have come up in favor of

specific business organizations. The shortage of micro components coming from Taiwan has been one of the first alarms. The value chains of the most important car makers in the world have been stressed and weakened suddenly. All these events have put the scholars in front of new stimulating challenges, one of the most intriguing is to come up with a theoretical framework that could better explain what is happening at the B2B digital platforms if they adopt a breakthrough innovation. Specifically, no explanations are available for comprehending the technological innovation adoption in response of the effects of a global crisis wave. We do not have an investigation that puts together the field of studies of B2B digital platforms, breakthrough innovations adoption and crisis management. The literature lacks a large comprehension of the perturbation mechanisms that affects a B2B digital platform and most importantly, the extant studies do not provide concrete tools for setting effective mitigation strategies.

The fueling complexity concerning the issue is mostly acknowledged. Addressing the issues is not a matter of a unique perspective solution. We should tap several angles of analysis and fields of studies belonging to a multiple spectrum of knowledge. In a nutshell, a specific point of view is not going to give successful answers. For this reason, this paper has exploited a two steps analysis. Firstly, reviewing the literature for building up a theoretical formulation (Khodarahmi, 2009). Next run four scenarios strictly related to our theoretical model. This paper provides an investigation that exploits the lens of analysis of adaptive management models. According to this theory we have observed the digital platform components and the crisis perturbation through the lens of adaptability to the uncertainty. Specifically, we conceived a response to a crisis as a kind of adaptation to external non known events and most importantly the capacity to fastly learn and absorb the missing information. Furthermore, we grounded our system dynamic simulation on these solid fundamentals to compare 4 scenarios. The results permit us to obtain a matrix of crisis mitigation strategies (Peruchi et al., 2022). These theoretical instruments provide four different crisis response patterns depending on the sensitivity adaptation and crisis perturbation spreading.

The first digital adaptation region strategy is characterized by high level of perturbation and high level of adaptation. The findings depict a digital transformation scenario where the high level responsiveness actors, such as B2B digital platforms or digital interface providers lose immediately the control of the digital transition. This scenario is referred to as the social network industry. During the Covid 19 outbreak this industry provides high level performance and demonstrates to reconfigure immediately the entire value chain for adapting the value proposal to the new upcoming needs. Under these circumstances the active adaptation style demonstrates a useful role for adopting a reconfiguration strategy.

The scenario with high crisis perturbation and passive adaptation level shows a high risk due to the protectionist approach. In this case the network actors could suffer from abandonment in favor of other more resilient and responsive B2B platforms. The example of some small companies in the food industry is adapted to describe our findings. Indeed, certain actors have been reluctant to join the food delivery digital platform by suffering a significant loss of customers during the Covid-19 outbreak. Our research suggests mitigating the impact by adopting a structural digital transformation strategy.

The scenario with low level of perturbation and high level of adoption shows a very fuzzy insight. The digital provider actors seem to be less hit by the perturbation but able to create success in the long run anyway. On the contrary, the great adaptation of some actors such as interface providers demonstrated some immediate good effects but without the high perturbation wave they will diminish in the long term. This scenario is represented by the case of traditional industries such as the automotive industry that should be more open to adopt B2B digital platforms to create a very systemic digital transition.

The scenario with low level of crisis perturbation and passive adaptation style demonstrates a very flat growth rate. Under these

circumstances we the strategy should be of making partnership with new actors with more digital adaptation propensity. This is the case of raw material sectors that are not being ready to create a digital transformation strategy. For these reasons our simulation suggests adopting a value chain collaboration strategy in order to cooperate for a synergic digital transition.

8. Implications and limitations

The theoretical implications of this paper are grounded in the field of study of B2B digital platform strategy. This work opens the route to new investigation per each matrix region strategy. Indeed, statistical investigation might be run to assess specific trends, according to the matrix axis. New studies might be fired up starting from opportunistic behaviors emerged from the simulations (Morrish and Jones, 2020). Besides, our B2B digital platform comprehends generic groups of users that correspond to a very plain value chain. A quali-quantitative study might be integrated to give a sector characterization by enriching the model with some peculiarity that in our pioneering study could not be tested (Khodarahmi, 2009).

The very urgent goal of this paper has been from the very beginning to give valid tools for fighting the crises that are storming to date global economies. So, the practical implications concern the strategy toolkits that the top-level management can exploit to sharpen the sensing capacity and mitigate the impact of a crisis. The four regions for strategy implementation could easily lead the practitioners towards the most effective mitigation strategy (Williams, 2011).

This research provides two significant academic implications. Firstly, we decided to group some variables according to the extant studies (Correani et al., 2020). This approach opens the route to a new way to manage the complexity of a B2B digital platform network. New further studies could exploit systemic perspective to analyze a real network with a multiple case study method. This approach could enlarge the knowledge about the features of the analyzed variables and potentiate the understanding of the entire B2B digital platform system. Besides the second implication is referred to the strategic matrix, the four could be analyzed individually by a deeper and deeper quantitative investigation for catching and understanding the perspective of the actors individually. Indeed, this research aims at being systemic but an actor level analysis, according to the four main strategic areas should be carried out. The findings could support the practitioners by providing a forecasting of what could happen under the two-by-two variable changes. The results permit us to understand which response strategy might be useful and if change the adaptation approach.

The limitation that affects our model is the degree of generalization. As with all the simulation we needed to make assumptions for the sake of clarity. Unfortunately, the model assumptions give some risks of missing specific systemic traits. We addressed this risk with a very straightforward and sticky session of literature review for coming up with a very consistent and robust model assumption.

Another limitation affecting our simulation is the number of actors. In the long term the magnitude of the crisis and the level of digital transformation reach might change the number of actors. We decided to fix the number for focusing on the value generation changes. Although another possible study could be performed by encompassing the change in B2B digital platform perimeter, by changing the nature and the number of digital network actors.

CRedit authorship contribution statement

Category 1

- Conception and design of study: A. Caporuscio, F. Schiavone, F. Bernhard, O. Escobar;
- Acquisition of data: A. Caporuscio, F. Schiavone, F. Bernhard, O. Escobar;

- Analysis and/or interpretation of data: A. Caporuscio, F. Schiavone, F. Bernhard, O. Escobar;

Category 2

- Drafting the manuscript: A. Caporuscio, F. Schiavone, F. Bernhard, O. Escobar;
- Revising the manuscript critically for important intellectual content: A. Caporuscio, F. Schiavone; F. Bernhard, O. Escobar;

Category 3

- Approval of the version of the manuscript to be published (the names of all authors are listed): A. Caporuscio, F. Schiavone; F. Bernhard, O. Escobar;

Data availability

No data was used for the research described in the article.

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Appendix A

Appendix 1

Description of Vensim simulation variables.

Variable name	Meaning	Time	Impact
User group A value chain	The variable represents the number of companies belonging to the group A of generic value chain	T = n	Total cost, Usability, Reach
User group B value chain	The variable represents the number of companies belonging to the group B of generic value chain	T = n	Services, Software, Hardware
User group C value chain	The variable represents the number of companies belonging to the group C of generic value chain	T = n	Policies, Standards, Protocols
Total cost	The variable represents the total cost generated by the B2B digital platform	T = n	Interface
Usability	The variable represents a parameter of degree to B2B digital platform can be used	T = n	Interface
Reach	The variable represents the range of B2B digital platform application, effect, and influence.	T = n	Interface
Interface	The variable represents the capacity of the B2B digital platform of enabling a user to communicate with the others.	T = n	B2B digital platform value generation
B2B digital platform value generation	The variable represents the capacity of B2B digital platform of generating value through the actors' connection	T = n	User group A value chain User group B value chain User group C value chain
Software	The variable represents the number of new software components developed for B2B digital platform deployment	T = n	Infrastructure components
Hardware	The variable represents the number of new hardware components developed for B2B digital platform deployment	T = n	Infrastructure components
Services	The variable represents the number of new services provided for the B2B digital platform maintenance	T = n	Infrastructure components
Infrastructure components	The variable represents the number of components implemented by B2B digital platform	T = n	Platform provider
Platform provider	The variable represents the technological value generated by the platform provider	T = n	B2B digital platform value generation
Protocols	The variable represents the number of new procedures adopted by B2B digital platform system	T = n	Platform orchestrator
Standards	The variable represents the setting parameters adopted by platform orchestrator for assessing the functional quality of B2b digital platform	T = n	Platform orchestrator
Policies	The variable represents the rules adopted by platform orchestrator for regulating the B2b digital platform	T = n	Platform orchestrator
Platform owner	The variable represents the value generated by the B2B digital platform shareholders	T = n	B2B digital platform value generation
Platform orchestrator	The variable represents the valuer generated by the actors that govern and manage the B2B digital platform	T = n	B2B digital platform value generation
Partnership reliability	The variable represents a parameter of B2B digital platform capacity to matching the actors' system adequately	T = n	Total cost Usability Reach
Network effect assessment	The variable represents a parameter of B2B digital platform system of absorbing, spreading, or blocking the effect of an external and not foreseeable event among the actors' system	T = n	Platform orchestrator
Technology availability	The variable represents a parameter of technological innovation degree of being ready for use	T = n	Infrastructure components
Crisis perturbation	The variable represents an external and unpredictable event generated by a catastrophe or a crisis	T = n	Partnership reliability Network effect assessment Technology availability

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