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Short Paper

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Abstract

Developing organizational resilience (OR) is now one of the core competencies for organizations' survival. Yet, OR development, as a response to disruptions, is context specific. With previous studies highlighting the type of disruption addressed, we find that the technology-incurred disruptions have received less spotlight due to the prevailing 'pro-ICT bias'. However, technology may also heavily disrupt organizations. Should an organization not be resilient towards it, its survival can be at risk. Among various methods and means of developing OR, digital resilience, which is to utilize information systems to develop resilience, is known to be critical. Therefore, we ask the following research question "How do organizations develop digital resilience addressing technology-driven disruptions?". Using the improvisational capabilities and the red queen hypothesis as our guide, we conduct an exploratory case study on the Korean online gaming industry. Preliminary analysis and results are shared and concluded with plans for future research development.

Keywords: Organizational resilience, improvisational capabilities, digital resilience, case study, red queen hypothesis

Introduction

Organizational resilience (OR) is an organization's '*ability to anticipate potential threats, to cope effectively with adverse events, and to adapt to changing conditions*' (Duchek 2020, p. 220). Amid recent events, such as the COVID-19 pandemic causing widespread disruptions globally, scholars argued OR to be one of the core competencies that organizations must develop in order to survive (Abbasi et al. 2021; Conz and Magnani 2020). Analogously, renowned international bodies such as International Organization for Standardization (ISO) also stress the criticality of developing OR for the survival of an organization.

Resilience, as a response to disruptions (Mallak 1998) requires organizations to first develop an understanding of the disruption and its impacts. Disruptions are '*predictable and/or unpredictable events having significant impacts to the normal operation or stability of the business*' (Ramezani and Camarinha-Matos 2020, p. 3) and thus, are events that incurs '*a fundamental change re-ordering the ways in which*

organizations and their ecosystems operate' (Kumaraswamy et al. 2018, p. 1025). Consequently, how organizations develop resilience becomes context specific and is often referred to as a 'Blackbox' (Duchek 2020). Therefore, unraveling this Blackbox, literature empirically investigating the development of OR mostly provides their contextual settings including what disruption is being addressed in their work. However, among the so-far studied disruption, less interest is set towards technology incurred disruption due to the '*pro-ICT bias*' (Majchrzak et al. 2016). Yet, ICT-related harms are also critical to understand (Majchrzak et al. 2016) and develop resilience against as organizations, regardless of their size or industry, can be influenced and may perish due to its consequences.

In developing resilience, studies offer a variety of methods each focusing on key assets or functions of the organizations. For instance, supply chain resilience is critical to achieve for organizations relying heavily on supply chains (Ponomarov and Holcomb 2009). Service resilience is offered by Huang and Farboudi Jahromi (2021) suggesting that for the organization to be resilient, the services they provide should be undisturbed even under extreme conditions. Likewise, digital resilience refers to a phenomenon of leveraging on information systems to develop resilience (Fong Boh et al. 2020). As organizations continue to adopt information systems and transform, technology is now deeply embedded with the organization's operations. Therefore, we understand that developing digital resilience may be a critical method of developing OR that organizations can commonly practice.

Upon such background, we raise the following research question, '*How do organizations develop digital resilience addressing technology driven disruptions?*'.

To further explore this research question, we adopt two theoretical notions, the improvisational capabilities (IC) (Pavlou and El Sawy 2010) and the Red Queen Hypothesis (RQH (Van Valen 1977)) as our lens. The IC, having roots in the dynamic capabilities theory (Teece et al. 1997), is tailored to better support the development of competitive advantage in a highly turbulent environment (Pavlou and El Sawy 2010). The RQH is a theoretical notion developed in ecology and biology studies focusing on the evolution of species and their survival. The introduction of RQH as a lens, leverages on the notions of business ecosystems (Moore 1993) adopted in business studies. As business environments resemble that of the natural ecosystem (Moore 1993) we expect that the RQH, a survival theory in the natural ecosystems study, would also allow us to develop unique insight in understanding how organizations develop resilience.

We conduct a case study on the Korean online gaming industry which is an industry that is heavily influenced by technology driven disruptions. The game developing and servicing is one of the industries that are heavily disrupted by both new and old technology. For instance, the recent uprise of block chain technologies and the Non-Fungible-Tokens (NFT) has brought about a new concept of 'Pay to Earn' to the industry. While this provides new opportunities for revenue stream diversification, it also disturbs the industry with unresolved and unchartered legal issues along with consumer distrust. It also challenges the fundamental understanding of 'what is a game?'. Another example of technology driven disruption can be found in the introduction of game publishing platforms (e.g. STEAM) and mobile gaming (e.g. Google Play Store, Apple store). With the introduction of these platforms the competition to secure stable number of users per game becomes even more fierce. Adding on, the game as a form of entertainment must also compete and/or cooperate with other entertainments that are being digitally enhanced and potentially can influence the game (e.g. Movies through OTT platforms, streamers through Youtube and Twitch, e-books, Music etc.). Upon such industrial characteristics we expect that a thorough investigation of organizations in this industry would provide valuable insights on how organizations have developed resilience addressing technology driven disruptions.

Sharing preliminary results, our study is expected to contribute to the literature in the following ways. Theoretically, we advance the original work of Pavlou and El Sawy (2010) and provide empirical evidence on how the characteristics SW artifacts evolve and change following the operational cycle of the organization in developing resilience. Also, by adopting theoretical notions developed in ecology on survival studies, we provide unique insights on how such improvisation through IS potentially reshaped the industry supporting the resilience of organizations within. For practice, we expect that our work may serve as a guideline in utilizing technology and strategizing for resilience development.

The remainder of this paper is as follows. We first introduce the theoretical background of this paper. The next section introduces the methodology and case description followed by preliminary analysis and a discussion for future research.

Literature Review

Technology Driven Disruption and Organizational Resilience

The emergence of new technologies and their application may reshape the industry and cause disruptions to organizations. For instance, the emergence of platforms such as Uber and AirBnb has disturbed the hotel and travel industry. More recently, crypto currencies and NFT built upon block chain technology also caused disruptions to finance and creative industries. Likewise, Karimi and Walter (2016) report that traditional news media companies feared and suffered losing their dominance in markets as the emergence of new media channels reshaped the industry and changed the way news were created. However, in research such technologies and adoption cases have often been subjected as examples to study 'disruptive innovations' (Christensen et al. 2013) emphasizing the innovations they have brought and undermining the disruptions they have caused. Yet, as such change disturbs the traditional, it also incurs the need for organizations to develop resilience in order to survive. As organizations increasingly rely on technology for their operations and development, the importance of resilience towards technology driven disruptions grows to become critical.

As these disruptions occur continuously with their impacts lasting in the business environment, the development of OR should also be continuous. Studies such as Conz and Magnani (2020), Duchek (2020), and Hillmann and Guenther (2021) suggest that OR development is a dynamic process involving the organization's action against prior, during, and after encountering disruptions. Accordingly, a variety of dimensions is considered for the development of OR (Table 1) and studies investigate into the subsequent capabilities required in each phase. As each phases influences one another (Conz and Magnani 2020) the challenge of developing OR increases.

Phase	Dimensions
Pre	Preparedness, Anticipation, Monitoring, (Response) Planning, Avoidance, Preempting
During	Agility, Adaptation, Response, Adjustment, Evaluation, Cohesion, Robustness, Recovery
Post	Restoration, Healing, Transformation
Table 1. Dimensions of Resilience (Ahmed et al. 2021)	

In overcoming the challenges of OR development, technology plays a critical role (Abbasi et al. 2021; Fong Boh et al. 2020). However, relevant studies in IS are focused more on developing a resilient IS. As many services today are delivered through IS (Gill and Chew 2019), there is an underlying assumption that a resilient system will enable the resilience of organizations. Consequently, less studies investigated into how IS supports the development of OR within the environment it is embedded in (Heeks and Ospina 2019). However, due to the recent pandemic and the surge of need for more IS studies on resilience development, more studies are now adopting the socio-technical perspective of IS and investigate how technology enables the development of resilience (Chatterjee et al. 2021; Papagiannidis et al. 2020).

Improvisational Capabilities

The improvisational capabilities were developed from dynamic capabilities (Pavlou and El Sawy 2010) but has been modified to better suit capabilities development during disruption. For an organization developing a dynamic capability, a process of sensing, seizing and transforming takes place (Teece et al. 1997). However, during disruptions organizations may not have the luxury to conduct their sensing phase. Thus, the improvisational capabilities suggest that the development of capabilities occur through a constant cycle of seizing and transforming allowing organizations to spontaneously respond to disruptions (Pavlou and El Sawy 2010; Teece et al. 1997).

In developing resilience, technology plays a pivotal role (Abbasi et al. 2021; Fong Boh et al. 2020) gearing this cycle. Accordingly, Pavlou and El Sawy (2010) suggest three different categories of software artifacts that support the improvisation of organizations (Table 2). In their original studies, the disruption considered was a period of new product development which is described as '*environmental turbulence is prevalent in new product development with rapidly changing customer needs, frequent technological*

breakthroughs, and unpredictable new product introductions by aggressive competitors' (Pavlou and El Sawy 2010, p. 446). In the course, the role of the Project Resource Management System (PRMS) and Cooperative Work System (CWS) were found to be significant. Adopting their framework, in this study, we investigate how these software artifacts support the development of improvisational capabilities addressing technology driven disruptions.

Component	Description
Project and Resource Management System (PRMS),	IT tools for resource allocation, task assignment, and scheduling
Organizational Memory System (OMS)	Knowledge coding, directories, and retrieval IT functionalities, supporting the acquisition, assimilation, transformation, and exploitation of knowledge practices
Cooperative Work System (CWS)	Conveyance, presentation, and convergence systems supporting real-time communication and group collaboration
Table 2. IS artefacts for improvisation (Pavlou and El Sawy 2010)	

Red Queen Hypothesis

Developing OR requires organizations to improvise and adopt to the rapidly evolving environments. Thus, studies extensively investigate into how organizations have changed within themselves as a result of OR development (Lengnick-Hall et al. 2011; Riolli and Savicki 2003). Yet, in the light of the term 'business ecosystems' (Moore 1993) describing that organizations *'work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations (pp. 76)'* organizations are now required to reach outside their organizational boundaries and build networks that would enable their competitive advantage (Adner 2017; Jacobides et al. 2018; Tan et al. 2020). Likewise, OR development also occurs within its environmental context and thus, we find that the survival-related theories in the ecosystem literature may also serve as a lens guiding us to understand how organizations develop resilience.

The RQH is named after the Red Queen in '*Alice in wonderland: Through the looking glass*' (Carroll 1899) quoting '*Now, here, you see, it takes all the running you can do, to peep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!*'. Adopted first by ecology and biology studies, it describes the accelerating rate and speed of reproduction bringing out the evolution of species. Through the continuous high-speed evolution, species develop a competitive advantage and become a better fit to their relative environment faster than their competing species. As a result, the probability of survival of that species increases (Van Valen 1977).

This theory has previously been adopted as a theoretical lens in IS studies investigating strategies for technology adaptation and their influence on organizational competitiveness (Agarwal and Tiwana 2015; Foerderer et al. 2018) and consequently accelerate the competition and/or reshape the industry. As the original theory discusses the evolution of a species within its' given environment, we believe that adopting the lens to business studies would allow us to not only understand the improvisation that occurs within an organization but also how it influences and reshapes the industry.

Method and Case Description

As the aim of this research is to gain an in-depth understanding on how technology supports the development of OR facing technology driven disruptions, an exploratory case study is conducted. The case study method is used for research investigating the 'how' questions (Walsham 1995). Developing OR involves a complex, multifaceted, and multilateral process (Duchek 2020; Ma et al. 2018). Thus, needing to examine multiple stakeholder's actions, a qualitative case study method better guides us to establishing our understanding over a quantitative approach.

The online gaming industry is selected as our case to investigate as it is an industry that showcases a highly dynamic and competitive environment that is heavily disturbed by technologies. The operations of

companies in the gaming industry can be divided into two phases: the development phase and the service phase. In the game development phase, the efforts are geared towards crafting. Crafting of a game is often referred to as a 'composite art' as it incorporates not only technology (i.e. software programing, graphics and physics engine, hardware devices etc.) but also graphics, music, storytelling and more. The team, often referred to as a developing studio, is mostly consisted of developers that weave all these contents into a serviceable game. Once the game is launched the formation of the team drastically changes. Most of the developers move on for a new project while minimum remains for future updates and maintenance, the vacancy is replenished with those focusing on customer service, daily operations, communications and management. While this is a typical cycle for one game, the company has many ongoing projects that are situated at different phases.

Therefore, the disruptions that the organization face are very different depending on where their projects are situated at. During the development phase the disruptions are mainly related to the emergence of new technologies. Yet the new technologies can be either something completely new and groundbreaking or can be major updates in the tools that are already being used. For instance, the recently emerging blockchain and NFTs built upon the blockchain requires the organization to completely redesign their product, create new rules for service and explore the uncharted area of the industry. In another example, the concept of multi-platforms service (i.e. a game being synced between multiple platforms (desktop computer, mobiles, consoles etc.) and providing seamless experience to users) requires a completely different approach for development as there are more things to consider during the development.

In the launching and serving phase, the traditional market environment is also found to be disrupted due to technology. The development of new channels for gaming such as through consoles, platforms, and mobile has ground shifted the market environment. The practice of when to release, how to release and to whom to release has all been disturbed. In addition, games as digital goods, interact with their consumers brewing unpredictable consequences and disrupting the normal operations. Also, while the organization tries to maintain their service quality under such circumstances, the legacy accumulated in the product over time creates yet another challenge.

With such background on the disruptions the online gaming industry is exposed to, we focus on the Korean online gaming industry. As of 2021, the Korean gaming industry has successfully increased their global market share to be ranked in the 4th place internationally following US, China, and Japan (KOCCA 2021). The 21.3% increase of the total revenue this industry has gained in 2021 (KOCCA 2021) demonstrates that the industry overall has successfully survived, and moreover, thrived. Yet, statistics shows that at the same year, mobile gaming composed about 57% of the domestic gaming market share while PC based online gaming only covered 26% (KOCCA 2021).

For the research, individuals from 6 online gaming companies were selected. The subjected companies were selected by the following criterion. Firstly, the company should have survived for a long period of time. Sustaining this period, we expect that these organizations have constantly improvised and developed resilience throughout time. Secondly, the company should have the capacity and experience both in developing and servicing games. This is to ensure that we may capture how the required improvisational capabilities have developed between the product development phase and the product service phase. Lastly, the company should be large enough with multiple games currently on service. Having multiple serviced title and consequently, being able to secure market shares allows the organization to have influence on the legal authorities when developing and imposing regulations.

From the subjected companies, the oldest has started their service as early as in the 1990's with the most recent being in mid-2000's. 4 of the 6 companies are ranked in the top 5 of market share in 2021 and the total of their revenue is estimated to be more than 800 million USD. With each company currently developing and servicing multiple games, what they provide is in the top rankings in player/viewer numbers, excluding the online games serviced by foreign companies such as Riot Games (League of Legends) and Blizzard (World of Warcraft, Overwatch, Diablo etc.). Lastly, although the interviewed companies are presented in pseudonyms the so called '3N' (a metaphor used in Korea representing the three largest and most influential online gaming companies) and companies that are following closely behind are included for interviews.

We have invited total 16 individuals, each with minimum 5 to maximum 20years of field experience, currently working in these 6 companies (Table 3) for an interview. Each interview was about 1 hour long, and questions related to how each organization managed the disruptions were asked.

Name of Company (Pseudonym)	People interviewed	Interviewee description
Mercury	5	Chief (1), Manager – Business division (1), Manger - Game Alpha (2), Manger - Game Beta (1)
Venus	3	Manager – Business division (3)
Earth	1	Manager – Business division (1)
Mars	1	Director (1)
Jupiter	2	Manager – Business division (2)
Saturn	4	Director (1), Manager – Business division (3)
Table 3. List of Interviewees		

Preliminary Findings

In this section, we present some of the preliminary findings. As this paper is a short paper, we report one of the findings on how IS has supported the improvisation of organizations for resilience addressing the above-mentioned disruptions.

The Traditional Structure of Game Development and Service

In Korea, due to the nationwide implementation of high-speed internet in the late 1990's and powered by the widespread of internet cafes, PC based online games dominated the game service market. Being a pioneer of this new industry, most of the organizations developed and serviced game titles by themselves. Thus, a typical company would focus on developing and servicing a few numbers of large titles.

As the owner of the product and service, each studio took full responsibility and control for updates and maintenance. Providing 24/7 service each game presented periodic and seasonal updates for contents, conduct weekly bug fixes and maintenance for any miscellaneous throughout the provision. Such consistent service together with quality was the key to achieving customer satisfaction and retention.

However, the industry started to experience disruptions by the incidents described above. While the product level disruptions were managed mostly on a case-by-case approach, the need to improvise for resilience surfaced with the disruptions influencing the market conditions such as introduction of mobile gaming and third-party platforms providing games on a global level or new technology with the potentials to be implemented to and reshape games.

Improvising for Resilience in Product Development

"Through the recent few years, we have learned that the usual 'equation of success was no longer valid."
(Mars)

The traditional 'equation of success' was to have a small number of largely successful titles. Yet, with the change in the environment, companies realized that the success of a few projects no longer can guarantee their survival.

"We have an internal repository which is a collection of all our past projects – either failed or successful. The collection not only includes code piece, but everything related to game development including patents, artworks, scenarios and more enabling an instant mix-and-match. Any developer within our company may access them when needed. this greatly helped us to catch up with new trends and changes. … I am sure other companies would also have something like what we have." (Mars)

Acknowledging the need to improvise to become resilient, the OMS, previously defined by Pavlou & El Sawy (2010), is found to play a critical role. Previously, the OMS was independently managed by each studio. However, improvising for resilience, the company integrated the fragmented OMS into one central OMS. The central management also started to actively search new intellectual properties (i.e. original drawings, stories, design, code pieces, patents etc.) outside their organizations and accumulate them to their OMS. All these components are necessary for game development. Yet, each requires much time and cost should they be developed from scratch. Therefore, securing such resources for creativity, enriching their OMS, are critical capability for the game development.

> *"We have so many studios (independent game developing companies) that we have acquired by investments or M&A. It is difficult for anyone to follow up with all development status across the whole company. I sometimes also get to learn about new projects through our annual showcases."…"We now focus more on identifying potential studios to invest into rather than developing on our own."* (Earth)

In the course of improvising, the OMS also brought about a number of changes to the industry as well. The securing of IPs often occurred in the form of investments, M&A, and partnerships with small and medium studios with potentials. As the company expanded their boundaries and acquired more studios, the actual game development became more focused on the studio while the company themselves started to focus more on the backend management such as marketing, release scheduling, publishing, research and development, legal and other activities that all together better support the studios. The company was also able to explore into developing a variety of different game genres then they used to before and leverage on different publishing routes. Consequently, the speed of game production increased dramatically.

> *"Looking into recent releases, we find that the production period of a game dramatically shortened. Usually, it took us 3 to 5 years to develop and publish a game. Now, we do that in 1 to 2 years period."*
> (Venus)

Improvising for Resilience in Product Service

As the service of games span over decades, studios commonly pointed out that the biggest challenge they faced was creating new contents. While the internally enhanced OMS support the product development, there are limits to continuously provide new creativity suiting a specific game. To further develop tailored contents and satisfy the consumers, organizations started to search user communities, both dependent and independent of the studios. Such communities are found to serve as a collective intelligence specific for that game where individual users share bug reports, post new ideas, and provide feedback. The studios discover new ideas that can be adopted or find maintenance points the studio might have undermined. As these communities also aged together with the game, they have now grown into a rich repository serving as an OMS outside the organization.

> *"We've introduced the User Created Contents (UCC) to our servicing game and relied on them (players) for creativity and contents … Although it has some issues to resolve we think that it is a viable solution."*
> (Manager @ Game Alpha, Manager @ Game Beta /both from Mercury)

Taking a step further, some studios created platforms to release a part of their game (e.g., graphics, sounds, code parts etc.) to their users. Such platform became a new playground for users to develop their own contents using the resources and tools available within the game. Some of the contents generated from these platforms were later officially introduced to the game vitalizing the old games. The game continues to thrive with new enticing contents even with the huge legacy underneath. Such platforms, rich with accessible resource, is also found to serve as an OMS.

Discussion and Future Work

The preliminary findings shared in this short paper focus on how OMS improvises and supports the improvisation of organizations towards resilience across two different phases. During product development phase, the OMS confined within the organization, is strengthened, enlarged, and fortified. Thus, one of the key characteristics for a successful OMS is the organization's ability to identify and accumulate relevant resources. The change in OMS also reflects the change in the role of the organization. From front line development, the organization is transformed to focus more on backend support and service. As the organization continues to accumulate more resources through investments, M&A and R&D, the

collaboration between the central management and various studios has formed a structure similar to a business ecosystem changing how games are produced and serviced.

We find another form of OMS that has developed outside the organization during the product service phase. Developed in forms of platforms, forums and user communities, the collective contribution of consumers on a specific game creates an OMS in which organizations may seek new creativity and service ideas. However, as communities are less controlled by the organization and the accumulation of resource occurs naturally by consumers, some of the key characteristics to fully utilize this OMS is the organizations' ability to navigate and interpret. As the collaboration between the contributors and the organization through communities aims for a common goal, we also understand that this also forms an ecosystem-like structure.

The potential contribution of our study is as follows. Firstly, we advance the understanding of the original work by Pavlou and El Sawy (2010) and find that form of IS artefacts and its characteristics improvises for resilience over time following the organization's operational cycle. We also find that such improvisation potentially may also restructure the industry. Lastly, our findings have practical implications on how organizations can develop and utilize IS for resilience depending on their given context.

The next step of this research is to continue the analysis. While this short paper only highlights how the OMS improvises, we are still in search for the improvisation occurring in PRMS and CWS. Moreover, we also aim to introduce yet another survival theory. Known as the 'Black Queen Hypothesis (BQH)' this theory highlights how organs abandon critical functions to survive. We believe that the BQH will supplement the RQH to develop further insights on how organizations improvise and develop resilience.

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