The Dark Side of Digitalization:
Three Case Studies of the Negative
Implications of Information Technology

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STATEMENT OF ORIGINALITY

This is to certify that to the best of my knowledge, the content of this thesis is my own work. This thesis has not been submitted for any degree or other purposes.

I certify that the intellectual content of this thesis is the product of my own work and that all the assistance received in preparing this thesis and sources have been acknowledged.

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AUTHORSHIP ATTRIBUTION STATEMENT

Chapter 2 of this thesis is based on the published paper: Park, Ha Eun., and Tan, B. 2020. Keeping gamers hooked: The mechanisms of mobile gaming addiction. *Forty-First International Conference on Information Systems (ICIS 2020),* Hyderabad: Association for Information Systems (AIS). The chapter is also currently under review as Park, Ha Eun., and Tan, B. 2020. Blending compulsions: The underlying mechanisms of mobile gaming addiction at the Journal of the Association for Information Systems (review round 2). I designed the study, collected, and analyzed the data, and wrote the initial draft of the manuscript.

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ABSTRACT

While the use of information technology (IT) can have both positive and negative implications, extant information systems (IS) studies have predominantly focused on positive accounts of IT use over the years. This thesis aims to examine the emerging roles of IT and the unintended consequences of IT use. Although studying the dark side phenomena of IT use at different levels of analysis is important because the use of IT can have negative implications in hedonic, organizational, and societal settings, most of the existing research focuses on an individual level of analysis in a work context. This thesis, therefore, focuses on understanding how the use of IT contributes to unintended implications (1) in a hedonic context with an individual level of analysis, (2) in a work context with an organizational level of analysis, and (3) in a societal context with a societal level of analysis. More specifically, the role of IT in mobile gaming addiction, digital debt accrual, and Hikikomori development is examined in terms of its unintended consequences using three levels of analysis, respectively. Accordingly, three qualitative case studies are presented to answer the following research questions: (1) *"How do negative implications arise as a result of IT use in a hedonic context?"* (2) *"How do negative implications arise as a result of IT implementation and use at the organizational level?"* and (3) *"How do negative implications arise as a result of IT use at a societal level?"*

To address the first research question, the first case study chosen is Empires and Puzzles. This is one of the world's most commercially successful mobile games, rated as a top 10 grossing app in the role-playing games and strategy games category on both the iOS and Android platforms. The study examines this case to identify the specific mechanisms of mobile gaming addiction, thus representing one of the earliest in-depth studies to offer a hedonic perspective of dark side phenomena. In particular, this study reveals the mechanisms of how the

characteristics, features, and content of a mobile game influence gamers' psychological states and induce addiction.

To address the second research question, the second case study chosen is the Fintech Platform Company. The company has undertaken more than 100 systems development projects for multiple resource-constrained client companies that are likely to accrue digital debt. The study provides a theoretical framework of how digital debt is accrued as a result of systems development. Findings show that digital debt has negative organizational implications that not only influence individuals, but also the entire organization and a number of stakeholders.

Finally, to address the third research question, the third case study chosen is the Yokayoka Hikikomori Support Center. Based in the city of Fukuoka, this is one of the most successful Hikikomori treatment centers in Japan, using a variety of different treatment alternatives, both online and offline. The study suggests a theoretical framework of how IT contributes to Hikikomori development, a recognized mental disorder that manifests as a state of acute social withdrawal. Based on its findings, this study adopts a technology affordances and constraints perspective of the phenomenon to shed light on how IT induces the pathological behaviors associated with this recognized mental disorder, and thus may serve as a crucial first step toward its treatment.

Taken together, by addressing the research questions, these findings make several important theoretical contributions to the dark side of IT literature: 1) challenge the existing knowledge in this area, particularly knowledge centered on perspectives at an individual level in a work context by providing three empirically grounded theoretical frameworks that help address the lack of empirical studies on the roles of IT from the dark side research in a hedonic context, and at organizational and societal levels; 2) explore three aspects of negative outcomes on individuals, organizations, and societies; and 3) challenge the dominant position of existing

studies by providing empirical evidence of a process perspective on how the use of IT can result in negative outcomes by constructing detailed theoretical frameworks that identify the mechanisms used to illustrate the dark side at different levels of analysis.

Beyond its theoretical implications, this thesis also makes a number of contributions to practice: 1) serves as a detailed roadmap for practitioners through which to understand how the mechanisms work, and consequently to identify effective and appropriate interventions to dull the negative impacts on individuals in a hedonic context; 2) provides a comprehensive and empirically supported framework for practitioners who face difficulty in understanding and managing adverse impacts on organizations so as to use the theoretical framework as a detailed blueprint to assess and identify appropriate remedial actions; and 3) provides a detailed roadmap for practitioners who seek to understand the contributions of IT on negative social outcomes so as to design effective treatments and interventions and address the adverse social consequences.

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CHAPTER 1: INTRODUCTION

A large body of research in information systems (IS) has provided positive accounts of information technology (IT) use for many years. Yet, the increased reach of IT, defined as the pervasiveness of IT-mediated activity (Keen 1991), IT richness, referring to the flexibility and customizability of IT to individual user requirements (Rayport and Sviokla 1995), and IT embeddedness, paving the way for unguided, continuous use of IT, have dramatically increased the scope, scale, and intensity of the potentially unintended consequences of IT use (Markus and Mentzer 2014). Therefore, contemporary IS scholars have grown increasingly skeptical about the "dual nature" of IT (Tarafdar et al. 2007, p. 302), and emerging research is increasingly focused on the negative implications of IT use. This dark side of IT use refers to "a collection of negative phenomena that are associated with the use of IT, and that have the potential to infringe the well-being of individuals, organizations and societies" (Tarafdar et al. 2015b, p. 161).

With advances in digital technologies, the potentially negative implications of IT use have grown considerably. To illustrate, with the recent boom in cryptocurrency, 25 percent of Australians either own cryptocurrency or plan to buy it by the end of 2021, equivalent to approximately 4.8 million people (Blackburn 2021). However, a recent ABC news report showed that the rise of Bitcoin investment is driven by unsustainable online hype (Bali 2021). In addition, it reported that in 2020, more than 3,000 cryptocurrency scam reports were made worth $30 million in losses (Bali 2021), attesting to the potentially unintentional consequences of IT use. Moreover, recent studies have identified that near-continual use of IT induces stress among employees by blurring their work-life boundaries (Tarafdar et al. 2015a) and interrupting their primary task activities (Addas and Pinsonneault 2015). Such evidence

indicates an emerging dichotomy within IT in that its use can have both positive and negative outcomes.

As will be discussed further in the following section, although dark side literature has progressed to offer insightful propositions on an emerging phenomenon, a closer examination of the existing literature reveals three important research gaps (Alvesson and Sandberg 2011). First, previous studies have predominantly adopted a utilitarian perspective of technology in a work context, albeit with different lenses (refer to Table 1): technostress perspective studies view individual IT use as potentially resulting in chronic conditions of stress in the workplace (e.g., Ayyagari et al. 2011; Ragu-Nathan et al. 2008; Tarafdar et al. 2015a; Tarafdar et al. 2015c; Tarafdar et al. 2011); IT interruption perspective studies view IT use as having the potential to create task complexity and to divert an employee's attention (e.g., Addas and Pinsonneault 2015; Chen and Karahanna 2014; Gupta et al. 2013a; Gupta et al. 2013b); and IT misuse perspective studies focus on IT use as having the potential to create information security risks in a work environment (e.g., Bulgurcu et al. 2010; D'Arcy and Herath 2011; D'Arcy et al. 2009). While a handful of IS studies have started exploring the statistical correlation between the theoretical constructs in a hedonic setting (e.g., Tarafdar et al. 2020; Turel and Serenko 2012), they give scant attention to how IT use can result in negative outcomes in a hedonic context.

Second, most prior studies have focused on the outcomes of individuals' IT use (refer to Table 1), such as the negative outcomes of work overload and role ambiguity (Ayyagari et al. 2011) and reduced overall work performance (Tarafdar et al. 2015c). However, such outcomes at the individual level may have implications for organizations. For example, Tarafdar et al. (2015a) provided anecdotes that employee misuse of IT, ranging from malicious user behavior (e.g., stealing confidential corporate data), unsanctioned behavior (e.g., unauthorized access to a corporate network), to naïve user behavior (e.g., unknowingly opening an unidentified email),

can have security and financially related negative organizational implications. Without an adequate understanding of the negative implications of IT use in organizations, it will be difficult to manage or account for them holistically.

Third, although research interest in the societal impacts of IT has increased (Majchrzak et al. 2012), there are still only a few studies that examine the negative implications of IT use at this level. A recent *Sydney Morning Herald* article suggests that the use of smartphones and social networking sites (SNS) have increased isolation and describes social media use as an engine and accelerant of loneliness because users constantly compare their own lives to others' highly curated social media personas (Turner 2020). In addition, other studies on negative societal impacts have examined specific IT artifacts, such as work-related IT (e.g., Chen and Karahanna 2018) and SNS (e.g., LaRose et al. 2014; Tarafdar et al. 2020; Turel 2015). While there is a growing awareness of the negative societal implications of IT use, focusing on a specific IT artifact may not be sufficiently encompassing to reveal the entire scope of societal implications.

Based on the review of the literature, prior studies have predominantly examined the negative impacts of IT use in a work context with an individual level of analysis (refer to Table 1). Hence, the area of dark side outcomes in a hedonic context, at an organizational level, and at a societal level remains largely unexplored. Without addressing these gaps, we cannot get a full sense of the extent of dark side of IT. With these gaps in the literature, this thesis seeks to answer the overarching questions of how the negative implications of IT use come about (1) in a hedonic context with an individual level of analysis, (2) in a work context with an organizational level of analysis, and (3) in a societal context with a societal level of analysis (the individual effects can have repercussions in societies). Context refers to the specifics of a given situation in which IT is used or developed (Lee and Baskerville 2003), whereas the level of analysis describes that IT use causes changes in the lives of individuals, organizations and

Table 1: Selected Studies on Dark Side of IT		
Source	**Context / Level of Analysis**	**Key Arguments**
Technostress		
Ragu-Nathan et al. (2008)	Work / Individual	Technostress manifests in decreased job satisfaction, organizational and continuance commitment. Therefore, technostress creators decrease job satisfaction, organizational and continuance commitment, whereas technostress inhibitors increase job satisfaction and organizational and continuance commitment.
Tarafdar et al. (2011)	Work / Individual	Individuals experience technostress due to a number of factors such as inability to deal with uncertainty and complexity of IT, a sense of insecurity due to rapid IT advancement, IT invasion of personal life and information overload. The consequences of technostress include decreased job satisfaction, commitment, productivity, and innovation.
Ayyagari et al. (2011)	Work / Individual	The antecedents of technostress include technology characteristics such as usability (usefulness, reliability), intrusiveness (anonymity, ubiquitousness), and dynamism (pace of advancement).
Tarafdar et al. (2015a)	Work / Individual	The dark side of IT reduces the productivity of individual employees. Some of the negative effects of technostress include feeling forced to multitask due to real-time information feeds and working remotely. Complex user interfaces also create stress as they create work overload.
Tarafdar et al. (2015c)	Work / Individual	Technostress impair innovation and task performance and reduce individual work performance. Technostress creators (factors that create stress from the use of IT) can be reduced by building technology competence.
IT Interruptions		
Gupta et al. (2013a)	Work / Individual	The effect of perceived task complexity on information overload and task performance in a work environment depends on the hierarchical level of the message sender. Interruptions from a supervisor reduce primary task completion time but aggravated the negative impact on task quality, while interruptions from a peer increased primary task completion time.
Chen and Karahanna (2014)	Work / Individual	The frequency of work-to-nonwork interruptions (which originate from work and take place in the domain of personal life) is associated with work-life conflict, whereas the frequency of nonwork-to-work interruptions (which originate from personal life and take place in the work domain) influences fulfillment of work responsibilities.
Addas and Pinsonneault (2015)	Work / Individual	Slow, buggy or complex systems create an intrusion that decreases task concentration and adversely influences individual performance, whereas for human-generated interruptions, some technology features (multimodal alerts, parallelism) overload cognitive attention and other feature (reviewability) positively affects individual work.
IT Misuse		
D'Arcy et al. (2009)	Work / Individual	User awareness of security countermeasures, security education, and computer monitoring deter IS misuse by increasing the associated perceptions of sanctions. The perceived severity of sanctions can effectively reduce IS misuse more than certainty of sanctions.
D'Arcy and Herath (2011)	Work / Individual	An individual's low self-control, overall confidence in his/her ability to use computers or specific IS tasks/applications, and personal moral beliefs have a strong influence on various forms of illicit behavior, including corporate crime.
D'Arcy and Devaraj (2012)	Work / Individual	The need for social approval and moral beliefs lead to IT misuse. Employees who work more days remotely are more prone to misuse their organization's technology resources.

societal collectives (Tarafdar et al. 2015b). Accordingly, the purpose of this thesis is threefold.

First, based on a netnographic case study of *Empires and Puzzles*, one of the most commercially successful mobile games, rated as a top 10 grossing app in the role-playing games and strategy games category on both the iOS and Android platforms (Ross 2018), this thesis seeks to investigate how a hedonic IT artifact (i.e., mobile game) induces negative consequences (i.e., addiction) among individuals (i.e., gamers). In this study, the dark side phenomenon is represented as mobile gaming addiction, which is defined as a maladaptive psychological dependency on mobile gaming (Sun et al. 2015). With its findings, this case study will represent one of the earliest in-depth studies of the adverse impacts of a hedonic IT artifact on individuals, challenge existing knowledge and the pervasively positive accounts of the hedonic IT artifact and provide a comprehensive and empirically supported framework for individuals, the institutions who are helping gaming addicts, and policymakers who seek to understand and mitigate such addiction.

Second, based on a case study of Fintech Platform Company (FPC – a pseudonym), that has undertaken more than 100 systems development projects for multiple resource-constrained client companies that are more likely to accrue digital debt, this thesis will examine how the dark side phenomenon (i.e., digital debt accrual) arises at the organizational level during systems development. Digital debt is currently conceptualized as an organization's cumulative buildup of technical and informational debt related to the maintenance and evolvability of a business that represents performance risks in an organization's work processes (Rolland et al. 2018). Of its two sub-components, technical debt refers to "the expected cost or effort entailed" in creating shortcuts during technical redesign, component upgrading, or wholesale replacement of a system architecture (Woodard et al. 2013, p. 540), while informational debt refers to the content inconsistencies and gaps embedded in digital infrastructures and work

processes (Rolland et al. 2018; Seaman and Guo 2011). With its findings, this case study will contribute to an organizational perspective of the dark side of IT and provide practitioners with a holistic and systematic framework for understanding the process of digital debt accrual.

Third, using a case study of the Yokayoka Hikikomori Support Center (YHSC), based in the city of Fukuoka and one of the most successful centers in Japan in treating Hikikomori through a variety of different online and offline treatment alternatives, this thesis will provide an in-depth examination of the underlying process by which IT contributes to the development of an increasingly important societal ill (i.e., Hikikomori development). Hikikomori refers to a recognized mental disorder that manifests as "a state of social withdrawal for more than 6 months, not going to work or school except for occasionally going out, and not communicating with people besides family members" (Koyama et al. 2010, p. 70). In doing so, this case study seeks to identify a specific mechanism through which IT enables and exacerbates Hikikomori development and open the "black box" of the relationship between IT and Hikikomori development. With its findings, this case study will contribute to knowledge on the dark side phenomenon at a societal level (although Hikikomori manifests in individuals, its implications are at the societal level) and provide useful prescriptions for stakeholders who help and treat Hikikomori (e.g., key members of Hikikomori support centers, psychiatrists and caregivers), practitioners, and IT developers who are interested in the development of digital treatment options.

Beyond its academic significance, this thesis aims to serve as a useful reference for practitioners by identifying detailed mechanisms of IT and a roadmap of its negative roles (1) in a hedonic context with an individual level of analysis, (2) in a work context with an organizational level of analysis, and (3) in a societal context with a societal level of analysis. Corresponding to its purpose, the research questions that this thesis aims to answer are: (1)

"How do negative implications arise as a result of IT use in a hedonic context?" (2) *"How do negative implications arise as a result of IT implementation and use at the organizational level?"* and (3) *"How do negative implications arise as a result of IT use at a societal level?"*

This thesis is organized into 6 chapters. The first chapter has established the motivation and the research questions that this thesis intends to answer. In the second, third, and fourth chapters, I present three case studies and use empirical findings to address the three research questions set forth at the beginning of this thesis, respectively. Each case study is further divided into six sections: an introduction, a literature review of the specific phenomenon of the study to construct a foundation for the subsequent theoretical arguments, the research methodology, findings, discussion, and conclusion (i.e., theoretical implications, limitations of each study, and implications for practice). The fifth chapter concludes with the overall theoretical and practical contributions of the thesis.

CHAPTER 2: BLENDING COMPULSIONS: THE UNDERLYING MECHANISMS OF MOBILE GAMING ADDICTION

2.1 Introduction

Mobile gaming refers to electronic gaming entertainment through mobile devices, such as smartphones and tablets (Jeong and Kim 2009). It makes up the largest revenue segment in the gaming industry, generating USD$70.3 billion in 2018, which represents a 51% share of the global gaming revenue (Wijman 2018). Although recreational when appropriately used, mobile gaming may nevertheless have a potential "dark side" (Sun et al. 2015) that could induce pathological behaviors, including excessive use, obsessive overdependence, withdrawal, and uncontrolled spending (Kwon et al. 2016). And yet, it may be precisely these pathological behaviors that contribute to the immense revenue generating capabilities of mobile games in the gaming industry (Wijman 2018).

Mobile Gaming Addiction (MGA) is defined as a maladaptive psychological dependency on mobile gaming (Sun et al. 2015). It is widely acknowledged that MGA has the potential to destroy lives, and can manifest in uncontrolled spending (Shah 2018), deteriorating physical health, compromising job or educational responsibilities, and the breakdown of interpersonal relationships for the sake of playing mobile games (Chen and Leung 2016). Classified as an official illness by the World Health Organization (Hoggins 2019), mental health professionals have reported that the symptoms of gaming addiction resemble those of cocaine addiction (Hsu 2018). To illustrate, stories like that of an Australian man who spent his entire savings for his wedding on a mobile game (see Shah 2018) are commonplace, attesting to the potential of mobile gaming for inducing pathological behaviors.

The mobile gaming literature has historically focused on the antecedents of playing mobile games (e.g., Merikivi et al. 2017; Rauschnabel et al. 2017) or the development of features for attracting and retaining players toward the commercial success of the games (e.g., Kim et al. 2014; Shibuya et al. 2015). More recently, a handful of studies have examined its potential dark side, exploring the negative physical, social and psychological consequences of MGA (e.g., Kwon et al. 2016). However, the precise mechanisms of a mobile game that induce addiction has not been the subject of adequate research attention. Instead, in attempting to pinpoint the cause of MGA, much of the existing research have adopted a demand-side perspective, focusing on the personality traits that render an individual more susceptible to becoming addicted (e.g., Billieux 2012; Chen and Leung 2016), and the motivations for playing mobile games (e.g., Sun et al. 2015).

And yet, a supply-side (i.e., the gaming company's) perspective may be crucial to understanding MGA because studies conducted in the context of traditional computer gaming have shown that there are indeed elements of a game that can induce addiction (see King and Delfabbro 2009; King et al. 2011). More specifically, games can be deliberately engineered to be significantly more addictive than other games by making them "particularly good at simultaneously tapping into what is typically formulated as game/not game, social/instrumental, real/virtual" (Taylor 2009, p. 153), which can present a potent blend of mechanisms that has the ability to activate an individual's compulsions. Moreover, addiction studies conducted in the context of traditional computer gaming may not be directly applicable and relevant to mobile gaming (e.g., King and Delfabbro 2009; King et al. 2011). This is because mobile gaming differs from traditional computer gaming along a number of dimensions such as device limitations, monetization strategies, socialization mechanisms, and nature of content (see Ha et al. 2007; Liu et al. 2012; Sun et al. 2015; Teng 2017). In particular, mobile gaming, characterized by less immersive features and "lighter" content, presents a stark contrast to the

time- and attention-intensive forms of playing that characterize traditional computer games (Teng 2017). Therefore, the findings and prescriptions for mitigating gaming addiction from studies conducted in the context of traditional computer gaming may not be fully relevant or applicable to the context of mobile gaming.

It is important to address these knowledge gaps, because as Kwon et al. (2016) and Chen and Leung (2016) suggested, the adverse physical, social and psychological consequences of MGA are an increasingly important social ill in contemporary society. To this end, the aim of this study is twofold. First, this study will adopt a supply-side perspective to explore the crucial yet overlooked mechanisms of mobile gaming that induce addiction among gamers. In doing so, this study aims to provide unique insights into the phenomenon to complement the dominant demand-side perspective. Second, beyond its academic implications, this study also aims to provide indications to practice on how MGA arises. This would be an important first step for policymakers and institutions who are helping gaming addicts (e.g., rehab centers) toward the development of effective treatments and interventions for the mitigation or prevention of MGA, and subsequently, minimize its adverse consequences. Accordingly, this study seeks to address the following research question: "How does a mobile game induce addiction among gamers?".

2.2 Literature Review

2.2.1 Existing Research on Mobile Gaming

Mobile games are designed to present a more accessible, sporadic, flexible and convenient gaming experience using hand-held mobile devices (Jeong and Kim 2009). It is significantly different from traditional computer gaming in the aspects of device limitations (Teng 2017), monetization strategy (Liu et al. 2012), socialization approach (Hsiao and Chiou 2012), and content richness (Alha et al. 2019). In particular, there are many unique characteristics of mobile gaming, such as portability (Hamari et al. 2018), perpetual connectedness (Park et al.

2014) and instantaneity (Ko et al. 2009), that present a distinct gaming experience (refer to Table 2). These characteristics give rise to a number of compelling benefits, which include the ability to play on the move (e.g., while waiting for transportation), instantaneous availability, and ease of use (Merikivi et al. 2017; Park et al. 2014; Wei and Lu 2014).

Table 2: The Unique Characteristics of Mobile Games	
Characteristic	**Comparison with Traditional Computer Games**
Portability	Mobile gaming allows a gamer to be on the move during play, whereas in the traditional computer gaming setting, a gamer is immobile and cannot leave the computer (Hamari et al. 2018).
Instantaneity	Due to its small file size, its perpetual presence in the gamer's pockets, as well as features such as automatic log-ins, players are able to download and access games instantly, unlike traditional computer gaming where downloading and installing a game, logging in and even locating a computer would require more time (Ko et al. 2009).
Perpetual Connectedness	Mobile gaming is ubiquitous and enables perpetual connectedness to a game, whereas a player cannot be connected to computer gaming all the time (Park et al. 2014).
Less Immersion	Mobile gaming provides a more casual form of entertainment that makes less demands of a gamer's time and cognitive capacity. In contrast, traditional computer games tend to have more sophisticated and engaging content (Alha et al. 2019).
Freemium Model	The majority of mobile games are based on the Freemium model, which means that the gamer does not incur any expenses for downloading or playing the mobile game, but can choose to make in-app purchases. In contrast, for traditional computer games, gamers typically have to purchase the game itself in order to start playing (Liu et al. 2012).
Small Screen Size	Mobile games are played on small smartphone/tablet screens, whereas traditional computer games tend to be played on large PC monitors or laptops (Rigby et al. 2016).
Simple Presentation	Mobile games tend to have simpler gameplay mechanics (e.g., match three) and graphics, whereas traditional computer games tend to have more sophisticated gameplay mechanics and graphics to foster immersion and longer playtime (Teng 2017).
Control Simplicity	Mobile games are played with simpler gestures such as touching and swiping fingers across the mobile device's screen, whereas traditional computer games tend to be played with complex controls utilizing a keyboard and a mouse (Thompson et al. 2012).
Momentary Entertainment	Each play session typically has a shorter duration (e.g., 15-30 minutes) for mobile gaming, designed as a tool against boredom or time filler that can be played anytime, anywhere (Merikivi et al. 2017). Conversely, traditional computer games require a dedicated time and place, and play sessions tend to be longer (e.g., 3-4 hours) (Lucas and Sherry 2004).
Asynchronicity	Gamers can play, compete and interact with other gamers asynchronously for mobile games, while traditional computer gaming typically entails synchronous play, competition and interactions with other gamers (Hsiao and Chiou 2012).

Despite its commercial potential, the negative implications of mobile gaming can be devastating, leading to severe uncontrolled spending, deterioration of physical and social conditions, poor academic performance, sleep disturbances, and other symptoms of pathological addiction (Jeong and Kim 2011; Kuss 2013; Lemmens et al. 2009). In particular, previous scholars have argued that MGA is distinct from habitual behavior because while habit entails automatic actions that are learnt, they are not typically associated with psychological dependency (Limayem et al. 2007). Conversely, MGA encompasses the following seven key components of behavioral addiction (Griffiths 2005), which include: (1) *Salience* (i.e., where mobile gaming is one of the most important activities in the gamer's life)*, (2) *Mood Modification* (i.e., where the gamer's mood is significantly influenced by mobile gaming)*, (3) *Tolerance* (i.e., where the resources or time invested in mobile gaming is significant)*, (4) *Withdrawal* (i.e., where discontinuing mobile gaming use gives rise to unpleasant feelings)*, (5) *Conflicts* (i.e., where excessive mobile gaming results in negative social consequences)*, (6) *Relapse* (i.e., where there is a tendency to revert back to prior gaming behaviors after discontinuance)*, and* (7) *Loss of Control* (i.e., where there is an inability to restrict the resources or time allocated to mobile gaming)*. An addiction is identified when these seven symptoms of behavioral addiction, especially the loss of control, are exhibited (Griffiths 2005).

The severity of the consequences of gaming addiction has sparked a growing awareness of the negative implications of mobile gaming (e.g., Chen and Leung 2016). While a majority of the existing studies on mobile gaming tend to focus on its business implications and the unique value it presents for gamers, an emerging body of work has recently called for a new understanding of the mechanisms and causes of addiction (e.g., Kwon et al. 2016). The cumulative body of work on mobile gaming, in turn, can be divided into three major research streams (refer to Table 3).

The first relates to the **antecedents** of playing mobile games. Studies within this research stream are aiming to identify the factors that attract individuals to play mobile games. Some of the most frequently identified factors include perceived enjoyment (Merikivi et al. 2017; Rauschnabel et al. 2017), number of other players (Alha et al. 2019; Wei and Lu 2014), perceived ease of use (Ha et al. 2007; Liang and Yeh 2011), and perceived usefulness (Park et al. 2014). As these factors form the motivation for playing mobile games, this stream of research can inform my inquiry by providing indications on what makes a game attractive (i.e., the initial roots of addiction). However, these studies tend to only emphasize the initial adoption of mobile games, which may limit the applicability of their findings because addiction is related to sustained and uncontrolled use (Sun et al. 2015).

The second stream is centered on the **features** of mobile games. Studies within this research stream are seeking to explain the features of mobile gaming that are different from traditional computer games, typically focusing on how the features are used by players and the effects of using those features. The more frequently explored features in the literature include the Freemium model (Liu et al. 2012), friend invitations through social media (Shibuya et al. 2015), aesthetics and user interface design (Cyr et al. 2006), push notifications (Milosevic et al. 2017) and mobile augmented reality (Kim et al. 2014). This stream of research can inform my inquiry by providing indications on the features that are unique to mobile gaming from which MGA can potentially arise.

The third research stream focuses on the **economic and social implications** of mobile games. Studies aligned with this research stream are generally aimed at revealing the economic and social impacts of mobile gaming on gamers. While the prior two research streams tend to cast the effects of mobile gaming in positive light, there is a growing awareness of the potential negative implications of mobile gaming in this third research stream. Billieux (2012), for

Table 3: Selected Studies on Mobile Games

Source	Key Arguments
Antecedents of Playing Mobile Games	
Ha et al. (2007)	Mobile games are easy to pick up and require only basic knowledge and skills for learning gameplay mechanics. Perceived ease of use and perceived enjoyment influence the intention to play mobile games, where psychological factors are more important than utilitarian factors.
Liang and Yeh (2011)	If a mobile game is easy to play, a player perceives it as playful and enjoyable. If mobile games are played in order to shift attention from work, a stronger intention to play continuously emerges.
Wei and Lu (2014)	The perceived number of users of a game and enjoyment and interaction with others are major motivations for playing mobile social games.
Merikivi et al. (2017)	Game design aesthetics, variety, challenge, novelty, and ease of use influence enjoyment that subsequently affect continuance intentions to play mobile games.
Rauschnabel et al. (2017)	Enjoyment and the game image influence favorable attitudes toward playing mobile games. In particular, augmented reality mobile games that involve physical movement such as walking a short distance tend to contribute to positive associations.
Development of Mobile Games	
Cyr et al. (2006)	User interface design and aesthetics including graphical elements such as layout, color and font influence the perceived attractiveness, usefulness and ease of use.
Liu et al. (2012)	Characterized by a freemium model, keeping a critical mass of free-to-play players is important even though they do not contribute to the game's revenue because it increases the awareness, visibility, and quality of a game. When more people download and play the game, the game's popularity increases, which may, in turn, generate more interest among paying players.
Lee and Raghu (2014)	Free trial offers, high user reviews, and continuous quality updates positively influence the sustainability of games on both the iOS and Android platforms.
Shibuya et al. (2015)	Players have easy access to their friends or other gamers through social media, chatting apps, and text messages on the mobile gaming platform. Gaming companies often incorporate a reward system to encourage players to invite more of their friends to play games, which serves to expand their customer base.
Fang et al. (2019)	Peers can influence a player's willingness to pay and make purchases. The impact of physical friends is more profound than that of virtual friends. Gaming companies should place a higher value on a player's physical friends and install a feature to invite friends to a game. When players play games with their friends, it tends to result in better monetization.
Social implications of Mobile Games	
Billieux (2012)	The excessive use of mobile phones may lead to behavioral addiction. If a person overuses the mobile phone for playing mobile games, this overuse may be a form of addiction. The symptoms of this addiction include lack of control, mood expectancies, and cravings.
Sun et al. (2015)	Mobile gaming addiction is more likely to get people into a "flow experience", that results in a psychological dependency on gaming.
Kwon et al. (2016)	The detrimental consequences driven by excessive dependence on mobile social games entail severe social and psychological impairment, as well as mental escapism, procrastination, poor academic performance, and poor time management.
Chen and Leung (2016)	The consequences of excessive mobile gaming include sacrificing job performance, educational activities, household responsibilities, interpersonal relationships, and psychological well-being.
Keogh and Richardson (2018)	Mobile gaming is interwoven with everyday life. While it can be played in short bursts, gamers tend to play it more frequently throughout a day and amidst daily activities, which can result in playing for more than two hours a day on average.

instance, argued that if an individual uses mobile phones excessively for gaming, it could manifest in a lack of control, mood expectancies, and cravings. Chen and Leung (2016), in a similar vein, suggested that MGA can create many problems and provided anecdotes of addicted players compromising or sacrificing their jobs, educational activities, household responsibilities, interpersonal relationships, as well as health and psychological well-being for the sake of gaming. This stream of research is important to this study because it highlights the physical, social and psychological consequences of MGA, as well as the potential severity of its negative implications.

Based on the literature review, I was able to identify at least two research gaps in relation to the research question. First, the existing research on gaming addiction tends to be centered on demand-side (e.g., gamers) factors, such as personality traits (e.g., Billieux 2012; Chen and Leung 2016) and the motivations for playing (e.g., Sun et al. 2015). But these factors only reveal that some individuals are more susceptible than others to MGA. The question of how mobile games induce addiction has not been adequately addressed and as explained earlier, this supply-side perspective is important because it is only when we are equipped with an understanding of the underlying mechanisms of MGA that we can begin to develop effective treatments and interventions for the condition.

A second research gap is that gaming addiction has rarely been examined in the context of mobile gaming. A dedicated study of this specific context is important because mobile gaming is significantly different from traditional computer gaming (as summarized previously in Table 2) in terms of device limitations, monetization strategies, socialization mechanisms, and nature of content (see Ha et al. 2007; Liu et al. 2012; Sun et al. 2015; Teng 2017). Consequently, the findings and prescriptions for mitigating gaming addiction from studies conducted in the context of traditional computer gaming may not be fully relevant or applicable to mobile games.

Moreover, of the handful of studies that explore addiction in the context of mobile games, they tend to be anecdotal and not supported by empirical evidence (e.g., Billieux 2012; Chen and Leung 2016). As such, I contend that an empirically grounded understanding of how the unique characteristics of a mobile game give rise to addiction among gamers may hold the key to addressing this increasingly important social ill.

To commence my inquiry, I first construct a theoretical lens (Walsham 1995) by turning to studies on gaming addiction conducted in the context of traditional computer games. This is because even though the arguments and prescriptions of these studies may not be fully relevant to mobile gaming, traditional computer gaming still represents a context that is arguably the closest or most similar in nature (Jeong and Kim 2009). Moreover, addiction is typically seen as the primary unintended or negative consequence of technology overuse (Turel et al. 2011). For instance, prior studies have demonstrated the existence and salience of addiction in relation to various information technologies including mobile emails (Turel and Serenko 2010), social media (LaRose et al. 2011), and gambling via social networking sites (Griffiths 2013). Consequently, the existing knowledge on gaming addiction will be appropriate as a "sensitizing device" (Klein and Myers 1999, p. 75) to guide this study on the underlying mechanisms of addiction in the context of mobile gaming.

2.2.2 Factors that Induce Addiction in the Context of Traditional Computer Games

Based on a review of the gaming addiction literature, the features that induce addiction in the context of traditional computer games can be classified into four categories: (1) socialization, (2) narrative and identity, (3) reward and punishment, and (4) presentation (refer to Table 4).

First, gaming addiction can be induced by features related to socialization, such as multi-player communication (Hsu and Lu 2004), alliance formation (Cole and Griffiths 2007), competition (Liu et al. 2013), leaderboards (Vorderer et al. 2003), and a support network (Goh and Wasko 2012). As these features enable communication and interaction between players (Junglas et al. 2013), they allow players to exchange text-based messages, form social groups, promote collaboration, encourage in-game progression, and build relationships. These features enhance the players' virtual presence and diversify the attention of players from merely finishing in-game objectives to satisfying other needs including a need to socialize and belong to a social group (Baumeister and Leary 1995). Certain players may also possess a desire for influence and recognition within the social group (Young 2010). These needs and desires are then translated into a motivation for players to apply more effort, play more frequently, and for a longer duration than intended. This can be because the gamers are prioritizing immediate gratification over any future harmful consequences of excessive gaming (Kwon et al. 2016).

Second, similar to film and music, games can present a variety of different features pertaining to a particular narrative and identity (Nandhakumar et al. 2013). The former provides a background setting and a storyline to intrigue and sustain the interest of players, while the latter places a player in a role and encourages the player to engage with the setting and achieve the game's objectives through the development of that role (Smahel et al. 2008). The creation and development of identity typically results in the creation of a digital representation of self (MacCallum-Stewart and Parsler 2008). The customized characters in a game may even be viewed as an extension of self or the ideal self (Belk 2013). The narrative and identity within a game are gradually developed by requiring the gamer to invest more effort, time and resources (e.g., money) as new settings and scenarios are unlocked that demand stronger in-game characters. The effort, time and resources required may subsequently make it more difficult for players to give up what they have already developed (Xu et al. 2012).

Table 4: Features of Computer Games that Induce Addiction	
Feature	**Definition**
Socialization	
Multi-Player Communication	Communication and interaction with other players, exchanging game strategies, sharing excitement, encouragement, and frustration through text-based messaging (Hsu and Lu 2004).
Alliance Formation	The constitution of "guilds" or "clans" for the purpose of cooperative game play, satisfying a fundamental human need to belong to a social group (Cole and Griffiths 2007).
Competition	Engaging players in a skill-based contest or tournament with other players (Liu et al. 2013).
Leaderboard	A tracking and feedback system to monitor and rank a player's in-game progression and a display of gaming results that can be used to compare performance relative to other players (Vorderer et al. 2003).
Support Network	A network of player-to-player relationships or virtual friendships that contributes to increased participation and enhanced performance in a game (Goh and Wasko 2012).
Narrative and Identity	
Character Development	In-game avatars that are digital representations of self, enabling non-verbal social interactions using gestures such as waving, jumping and laughing (MacCallum-Stewart and Parsler 2008).
Storytelling	An unfolding narrative that allows players to take on the role of a character against the backdrop of a virtual game environment (Smahel et al. 2008).
Game Resource Management	The control of in-game resources that determine success in a game, which can consequently provide a sense of mastery for players (Xu et al. 2012).
Reward and Punishment	
Skill-Based Rewards	Prizes awarded to players for skillful play, which can include in-game currency, resources, and experience points for upgrading a player's characters (Griffiths 2008).
Consequential Loss	A punishment that is meted out so that a player feels the pain of losing, which can include restarting a level, a loss of in-game resources, or the suspension of play (Chumbley and Griffiths 2006).
Achievement Trophies	Indication of a player's mastery over a game, which can be displayed as a series of icons or a graphical percentage rating. They encourage players to continue playing until they achieve total completion, which may be tied to an accumulated reward (King and Delfabbro 2009).
Participation Incentives	Token amounts of in-game resources or currency, such as the restoration of the health or ammunition of a character, are conducive to more frequent logins and constant play (Yee 2006).
Presentation	
Realism	The aesthetic and auditory qualities of a game that enhance the perceived authenticity and fidelity of a game's settings, which can trigger various affective states (Wood et al. 2004).
Control Scheme	The mechanics of gameplay that utilizes the physical configuration of a device (e.g., keyboard, mouse), which influences the difficulty of a game and the way game-related information is conveyed (Chappell et al. 2006).
Fantasy Themes	Artifacts and devices that place the gamer in a world that is removed from his/her everyday reality, which are associated with different in-game objectives. They can influence the desire to finish the game, overcome challenges, or improve game skills (Yee 2006).

Third, computer games also possess features related to reward and punishment, which evoke different emotions and responses for gamers that can foster addiction. For example, when a player perform difficult acts in game, skill-based rewards can be disbursed in the forms of in-game currency, items, and experience points that upgrades a character to a higher and stronger level (Griffiths 2008). Punishments may also be meted out when a player quits a game or loses, which makes losses consequential as in-game objects of value may be taken away from the player (Chumbley and Griffiths 2006). The rewards can also be in the form of achievement trophies as a player meets or fails to meet in-game objectives, which can trigger a player to continue playing as they are a reflection of the player's mastery of a game (King and Delfabbro 2009). Participation incentives in the form of small daily rewards can also motivate players to log into the game, and consequently be enticed to play more frequently (Yee 2006).

Fourth, there are features of a computer game related to its presentation that influences the extent of immersion and engagement for gamers. These features include the virtual realism that is underpinned by the aesthetic and auditory quality of a game (Wood et al. 2004), the control scheme (Chappell et al. 2006), as well as fantasy themes that place the gamer in a world that is removed from his/her everyday reality (Yee 2006). These features may trigger various affective states such as excitement, arousal, or even a feeling of romance (Wood et al. 2004). By gripping the attention of the gamers and setting off these intense affective states, it enables deeper immersion in the game, and can even precipitate the perception of time loss (Salen et al. 2004).

In summary, all of these features that can induce addiction in the context of traditional computer games may be potentially relevant to the context of mobile gaming as well. As such, applying this knowledge as a theoretical lens to analyse a case study of *Empires and Puzzles*, one of the most commercially successful mobile games on the iOS and Android platforms, a theoretical

model of how a mobile game induces addiction is inductively derived to address the research question set forth at the beginning of the paper.

2.3 Research Method

The netnographic research method was selected for this study because it adapts "traditional, in-person ethnographic research techniques of anthropology to the study of the online cultures and communities formed through computer-mediated communications" (Kozinets 2006, p. 281). Netnography examines human social interactions on online forums, blogs, or social media sites to identify and understand the needs, actions, and reactions in online user environments. It is an ideal method to use for under-researched computer-mediated communication concepts because it provides a view into cultural realities of online user interactions (Kozinets 2015). This method allows us to inductively derive theoretical concepts surrounding the phenomenon under examination in an unobtrusive manner (Kozinets 2015), which is in line with the potentially sensitive nature (i.e., addiction) of this study.

This approach is selected to studying the online environment because it allowed for more unobtrusive and naturalistic research (Wu and Pearce 2014). In particular, community members tend to change socially undesirable behavior if they are aware of being observed (Jerolmack and Khan 2014). Since addiction is often deemed to be socially undesirable, I considered it essential to observe and monitor the online environment in its natural setting to ensure the authenticity of the data (Kozinets 2015). It is less likely that alternative means of data collection (e.g., direct interviews with the stakeholders from the gaming company) will yield meaningful responses because the informants may not wish to explain how the game deliberately induces pathological engagement among players (Corbin and Janice 2003). Furthermore, the Hawthorne effect can be projected, which is defined as the informants' awareness of being

observed or monitored engenders active compliance that intentionally altering behavior and projecting responses in line with research expectations (McCambridge et al. 2014).

Based on the research question, I selected a case based on two criteria. First, the selected case should be a commercially successful mobile game as this typically means that the game has been able to extract value from its base of players. Prior research has shown that excessive spending on the part of players is one of the clearest indications of MGA (Shah 2018), and selecting a commercially successful game increases the likelihood of observing pathological spending behaviors. Second, under the assumption that the rate of gamer retention would correlate with the rate of addiction, the selected case should also have a large player base as it is an indication that they have been successful in retaining their customers. The case of *Empires and Puzzles* (E&P) is especially suited to this study because not only does this game have over a million weekly players, but it is also one of the most commercially successful mobile games, rated as a top 10 grossing app in the role-playing games and strategy games category on both the iOS and Android platforms (Ross 2018), making it a revelatory or an extreme case (Gerring 2009) for the purpose of this study.

E&P was developed by Small Giant Games, a gaming studio based in Helsinki, Finland, in 2017. E&P is a puzzle-based fantasy role-playing game that uses a match-three mechanic, which was popularized by Candy Crush (another immensely popular mobile game). The game offers "heroes" and "troops" to collect and upgrade, and each hero has unique special skills and attacks that are useful in battles. Players can also form an "alliance" with other players, participate in player-vs-player battles, inter-alliance wars, and fight collectively against monsters and titans. The game also offers the ability to build and expand a "stronghold" with various buildings to be built and upgraded. These buildings produce resources that are required for upgrading heroes and battle items.

2.3.1 Data Collection

Data from E&P's official online forum (https://forum.smallgiantgames.com) were used in this netnographic study. This is because the online forum is the most popular and comprehensive repository of information related to the game that is marked by interactive, active, and consistent engagement (Szmigin et al. 2005), as well as rich, discrete discussions between heterogeneous participants (Vallaster and von Wallpach 2013). The forum also has the highest amount of E&P related traffic on the Internet, consisting of approximately 1,300,000 posts, 1,600,000 likes, 80,400 active users, and over 49,800 topics. Consistent with previous netnographic studies (Kozinets 2002), this study was based on archival netnographic data, which refer to pre-existing secondary data that was generated and shared by forum members, including key insiders or lead users of the game who are frequently referred to, mentioned, referenced and quoted by both new and longstanding members (see von Hippel 1986). The archival data ranged from 2017, when E&P was first officially launched in the global market. The data include threads and posts, online articles, and information shared by E&P forum members. The credibility of the archival data was assessed based on the Porra, Hirschheim and Park's (2014) criteria for external and internal criticism. The former provides assurance of the credibility of the data sources, while the latter seeks to ascertain the validity of the content and the identification of deliberate and unintentional errors. In particular, a piece of evidence would only be extracted and used in analysis if it fulfilled the criteria of competence, expertness, objectivity, reliability and corroboration (see Porra et al. 2014).

2.3.2 Data Analysis

Data analysis was conducted in concurrent with data collection (Strauss and Corbin 1998) to take advantage of the flexibility of the netnographic research method. As part of the analysis, an initial set of three dimensions and 32 second-order themes (Dacin et al. 2010b) were first

derived from the review of the mobile gaming and gaming addiction literature to serve as a theoretical lens to guide the data collection (Pan and Tan 2011). More specifically, the dimensions and second-order themes were related to the characteristics of mobile gaming, the factors that induce gaming addiction, and the characteristics of MGA respectively described earlier in the literature review (summarized in Table 5).

Table 5: Themes and Sub-Themes of the Theoretical Lens	
Dimensions	**Second-Order Themes**
Characteristics of Mobile Gaming	Portability, Instantaneity, Perpetual Connectedness, Less Immersion, Freemium Model, Small Screen Size, Simple Presentation, Control Simplicity, Momentary Entertainment, Asynchronicity
Factors that Induce Gaming Addiction	Multi-player Communication, Alliance Formation, Competition, Leaderboard, Support Network, Character Development, Storytelling, Game Resource Management, Skill-Based Rewards, Consequential Loss, Achievement Trophies, Participation Incentives, Realism, Control Scheme, Fantasy Themes
Characteristics of MGA	Salience, Mood Modification, Tolerance, Withdrawal, Conflicts, Relapse, Loss of Control

The data collected were then coded (see example in Appendix A) using a mix of open, axial and selective coding (Strauss and Corbin 1998). In particular, open coding involved applying conceptual labels, primarily based on the terms used by the subjects studied (Van Maanen 1979), to the collected data to form first-order concepts (e.g., informants used the term "gacha" to describe buying loot boxes that were associated with a random chance of a significant reward), while axial coding was used to abstract and categorize the first-order concepts into a number of second-order themes (e.g., I categorized "gacha" as part of the second-order theme of "chance-taking"). Finally, selective coding was carried out to further abstract the second-order themes into aggregate dimensions (e.g., chance-taking was conceptualized as part of an Intermittent Reinforcement mechanism akin to what is seen in gambling). Moreover, if the derived theme/dimension went beyond the schema presented by the theoretical lens (Dacin et al. 2010b), the schema would be modified (i.e., concepts, themes or dimensions may be added, replaced, or deleted) and coding process would be restarted accordingly (Walsham 2006). This

process continued until each of the findings was supported by at least two sources of data to ensure the validity of interpretation of the events, activities and emotional responses of the forum members in relation to the mobile game (Klein and Myers 1999). The process of collecting and analyzing data, developing the emergent theoretical model and juxtaposing with the existing literature continued until the point of theoretical saturation was reached. This is a state where any additional data I was collecting were overlapping with those I already had on hand, and did not add further insights to those that have already been captured in the emergent theoretical model (Glaser and Strauss 1967).

2.4 Findings

Analyses of data suggest that MGA tends to be induced through the workings of three underlying mechanisms: (1) Affective Socialization, (2) Intermittent Reinforcement, and (3) Interest Rejuvenation. These three mechanisms, in turn, are enabled by certain game-related (i.e., instantaneity, perpetual connectedness, gameplay simplicity) and developmental (i.e., resource constraints, iterative development) characteristics of mobile games. I explain these characteristics and the three mechanisms, as well as present the corroborating evidence from this case study of E&P, in the following subsections.

2.4.1 The Characteristics of a Mobile Game that Induce Addiction

The mobile gaming characteristics that precipitate the three mechanisms of MGA I uncovered can be classified into two categories: (1) game-related and (2) developmental characteristics. In relation to the former, the first game-related characteristic is **Instantaneity**, which is what enables players to be entertained at any time, any place, and gain instant gratification (Ko et al. 2009). A player (Forum user ID: pob138) explained: *"When I switch between apps on my mobile device and return to the game, I am always logged in. I can switch back and forth and play games instantly. This is very convenient."* This parallels the arguments of Ko et al. (2009),

who suggested that instant connectivity is an especially important and unique characteristic in the context of mobile commerce. The mobile channel is distinct from the traditional context as it amplifies the value of convenience by enabling ubiquitous accessibility.

The second game-related characteristic is **Perpetual Connectedness**, which allows players to stay connected to mobile games all the time (Park et al. 2014). A player (Forum user ID: Lilsmoochi) provided an illustration of this characteristic: *"Our alliance members are all from different countries using different languages but are connected with each other. We discuss about the preparation for a war and the defence teams before staring a war"*. This characteristic is important because it allows players to break off and resume play or communication with other players at their convenience, which can create a sense of constant engagement (Huang and Hsieh 2011).

The third game-related characteristic is **Gameplay Simplicity,** which refers to the relatively simple user interface, control scheme, graphics, as well as the low attention demands of a mobile game (Thompson et al. 2012). A player (Forum user ID: Rapisu) described this characteristic: *"Gameplay is simple but optimizing our progress in the game requires a lot of thought and strategy. Alliance wars have brought a whole new aspect to team building. We not only have to plan how to set up our team to defeat the current enemy, but also what heroes to fight for the other teams"*. Thompson et al. (2012) indicated that mobile games are manipulated in a simple manner with the use of touch screen devices, that the players swipe their fingers across the mobile device screens. This user interface and control scheme tends to be unobtrusive and enables players to adapt easily, whereas traditional computer games are typically controlled with a keyboard and a mouse that is associated with a steeper learning curve (Chappell et al. 2006).

In relation to the developmental characteristics of a mobile game, **Resource Constraints** refer to the fact that mobile games tend to be developed by small gaming studios with a limited number of developers and resources. For instance, it has been reported that mobile gaming studios typically only have around ten developers, while gaming studios for expansive traditional computer games can have over 200 developers working on a single game. This can translate to slower progress in developing new content, or the tendency to aim for "lighter" content (Alha et al. 2019). A player (Forum user ID: TempestBlitz) explained: *"I saw the game had 600,000-ish players, and as far as I know, they have a (development) team of like, 10 people working at their company. I'd give them the benefit of the doubt being a smaller operation, but it's probably time to grow to adapt to what you've built so that you can have a solid community outreach, answer queries, make more improvements, and simply end the current cancerous stagnation"*. In other words, despite the resource constraints, there is nevertheless the need to develop new or update the existing content quickly and effectively, which is related to the next developmental characteristic.

A second developmental characteristic that is important to the findings is **Iterative Development**, which refers to the development of the content and features of a mobile game in an agile and incremental manner. A player (Forum user ID: Megalodon) provided an illustration of this characteristic: *"I can see that the developers are doing a terrific job of slowly interjecting ideas that we bring to the forum. I am very happy that they are listening to and reading our requests. Each update is an exciting step to a better game. Thank you, development team, for your hard work!"*. With iterative development, E&P is able to respond to player feedback quickly and push out new content and features that are aligned with the expectations of their player base in subsequent updates. This finding parallels the work of Tallon and Pinsonneault (2011), who suggested that the incorporation of an agile development process allows a firm to stay proactive and responsive to market change.

Collectively, these game-related and developmental characteristics enable three mechanisms through which MGA arises. I discuss each of these mechanisms in the following stream of reporting.

2.4.2 The Mechanism of Affective Socialization

The first mechanism, Affective Socialization, refers to a specific way of incorporating the elements of social networking into a mobile game for the purpose of fostering a tribalistic mindset. At E&P, this was enabled by the characteristics of Instantaneity (Ko et al. 2009) and Perpetual Connectedness, which supported the players' social interactions with other players (Hsu and Lu 2004), and allowed them to feel connected to one another all the time (Park et al. 2014). However, the way in which players interacted one another in E&P was characterized by **Constrained Communication**, where they were not allowed to freely communicate and interact with each other, except for the members of their own alliance. In particular, each player can only be involved in a single alliance of 30 players at a time, and a player cannot search for and specifically message other players outside of his or her alliance. This stands in stark contrast to traditional computer games where gamers typically had the freedom to communicate with other players in the game (King et al. 2010). A player (Forum user ID: Jordan) provided an illustration of Constrained Communication: *"The feature of searching alliances is very nice. But it would be amazing if we could search for specific players. In this way, we can keep friends who are not in our alliance or who do not show up in the global chat room."*

This inconvenience appeared to be a deliberate design choice because when players were only allowed to interact with the members of their alliance, they developed a siege mentality corresponding to a **Tribalistic Mindset**, which is defined as a close bond based on homogeneous usage, similar interests, an affective connection, and social "linking value"

(Cova 1997, p. 297). A player (Forum user ID: PooFlingerJr) described the Tribalistic Mindset that player in an alliance can possess: *"I've had the opportunity to play in a lot of alliances and meet a lot of great people. Once you find a spot where there are 29 people you like, it all just comes together. At least as a tribe, you should be able to weather whatever weirdness the (developers) throw your way knowing that 29 other people have got you"*.

This mindset, in turn, created an **Emotional Attachment** to their alliance, which refers to an affective commitment or feeling of belonging to a group (Baumeister and Leary 1995) that tends to manifest in an environment that is collaborative, and when a player's action promote the shared goals of a team that faces common challenges (Liu et al. 2013). This emotional attachment is evident from the following post in the forum (Forum user ID: SADERSpanda): *"(My alliance) is the reason why I still play. What an amazing collection of people I have met from all around the world… Funny how a "simple" game brings so many different people from so many different places together. Even funnier how we can all work together so well and how quickly we are to give up individuality for the team. Basically lots of great times had with these people, and would feel a pretty big empty spot if I stopped playing"*.

To summarize, because of Constrained Communication, a Tribalistic Mindset is formed for players in alliances, which can result in a social obligation to play the game longer and more frequently until a collective objective was fulfilled. There could also be penalties for not meeting these obligations (e.g., getting kicked out of the alliance), which could result in a player being ostracized within the community and reinforce a tendency toward conformity. The Affective Socialization mechanisms I uncovered is in line with the findings of previous studies, which found that the negative psychological consequences of social ostracism in a virtual environment could be as significant as in the real world (Williams et al. 2000). Moreover, Emotional Attachment can trigger more affective commitment to the game through the

expressions of encouragement, sharing of excitement and frustration, and being involved in a social group (Junglas et al. 2013).

2.4.3 Intermittent Reinforcement

The second mechanism, Intermittent Reinforcement, refers to the aspects of wagering and chance-taking that have been incorporated in E&P to induce either the euphoria of winning or irrational loss-chasing. This mechanism is enabled by the Instantaneity of mobile devices, which increases the immediacy of gratification and facilitates impulsive behaviors (Ko et al. 2009), as well as Gameplay Simplicity which, like slot machines, makes chance-taking easy and appealing to the senses (Thompson et al. 2012). Collectively, these characteristics amplify that impact of **Chance-taking** via what is known as "gacha" or "loot boxes", a lucky draw feature that randomly dispenses in-game resources when in-game currency is used, effectively creating a casino in the pocket (Griffiths 2018). This is different from the conventional reward mechanism in traditional computer games mechanics where players tend to be rewarded for skillful play (Griffiths 2008) and punished for losing (Chumbley and Griffiths 2006). Consequently, players who lack self-control may end up spending an inordinate amount of money until they receive what they want (see Shah 2018). A player (Forum user ID: Almeida) provided a description of Chance-taking and the gacha/loot box mechanism in E&P: *"Know that you won't get what you want. Occasionally you will. But unless you're going to be a 'whale' (i.e., a gamer who spends an inordinate amount of money on the game), there's never enough to guarantee you can just buy your desired outcome."*

Similar to gambling, the findings of this study suggest that Chance-taking has an effect on the player's psychological state whether the player wins (i.e., gets the desired reward) or loses (i.e., does not get the desire reward). When players win, they may experience **Arousal** (defined as the excitement and thrill when they gain, or are on the verge of gaining, a reward) or even

Euphoria, which refers to the highest state of arousal, a peak experience, and a highly condensed positive feeling at the moment of gaining a large reward (Blaszczynski and Nower 2002). Following this, many players described the **Satisfaction of Needs** as a result of gaining the desired reward. For instance, a gamer (Forum user ID: Alexey Bogachev) described how upon winning a reward, he took a screenshot of his win and shared it with his friends: *"I bought 2600 gems and got trash 3 starred heroes. But in the end, a picture appeared and showed that I received the hero of the month. I screenshotted it and showed to my friends."*

In contrast, when players lose or do not obtain the desired reward, they may experience **Loss Chasing**, defined as the irrational continuation of play with increasing monetary payments after a sequence of losing in gambling (Breen and Zuckerman 1999). Some players may give up if they continuously lose, but of this group, many would play again after a period of 'cooling-off' to sate their **Hunger** (for in-game resources). Hunger is defined as the psychological state of experiencing prolonged deprivation from not acquiring what a person desires (Griffiths 1990). The state of Hunger is evident from the following post in the forum (Forum user ID: Midnight.doom): *"After spending (US)$280, I still didn't get any 5 starred heroes. But I splashed some money today, though I said I wouldn't because I was excited about the event."*

In other words, MGA can stem from the mechanism of Intermittent Reinforcement through Chance-taking regardless of whether the player wins or lose. Echoing studies on gambling addiction, the former parallels the findings of Blaszczynski and Nower (2002), who suggested that the uncertainty associated with monetary risks offers a high level of arousal and increases the expectation of rewards, which makes players psychologically obsessed and reluctant to quit gambling. Similarly, the latter echoes the work of Griffiths (1990), who indicated that problem gamblers do not tend to regard themselves as losing, but nearly missing. Consequently, they

are more resistant to quitting when they lose. Instead, they tend to chase losses until they either gain the desired reward or all their money is lost, which has been identified as one of the most important steps in the development of gambling addiction. In a similar vein, the findings of this study suggest that some mobile gamers may not stop playing when their in-game resources are depleted, but instead, they may choose to continue playing driven by a desire to recoup the resources lost.

2.4.4 Interest Rejuvenation

The last mechanism, Interest Rejuvenation, refers to the measures employed within E&P to pique and retain the players' curiosity, sense of novelty and attention. This mechanism stems from the developmental characteristics of Resource Constraints and Iterative Development. In particular, traditional computer games are typically expansive, released as standalone and finished products, and updated less regularly (e.g., each year). Consequently, they enable a player to develop and manage a single character throughout the entirety of the game, and in doing so, the player may form an intimate attachment to, and experience a sense of unity with, their personalized character (Blinka 2008). However, with the "lighter" content in mobile games (Alha et al. 2019) and a lack of resources to offer finished, expansive products from the outset, E&P had to adopt a more dynamic role in continually developing and introducing content. Consequently, the development of E&P unfolded in an iterative manner with new content released more frequently (i.e., with each update spaced about a month apart). The findings of this study suggest that this **Incremental Content Release** is particularly effective for sustaining the interest of players. This is a practice where increasingly desirable in-game objects and game stages are released gradually and incrementally. The latter, in particular, presents a continuous stream of new challenge for players so that they will always have new objectives to pursue and will never complete the game (King et al. 2015). For instance, E&P is

currently in Season Three with new stages to play and incrementally more powerful heroes to obtain via the "gacha" feature for a limited period each month.

The perpetual pursuit of stronger in-game resources is stoked by **Curiosity Stimulation**, which generates favorable feelings of interest and exploratory behavior in a game (Chung and Tan 2004). This was supported by a **Sense of Novelty**, whereby players feel that the new content is surprising and unfamiliar, and there is always scope for exploration and discovery in the game (Merikivi et al. 2017). A player (Forum user ID: Cpt.Ahab) described how his interests in the game was sustained: *"Monthly heroes via new quests would keep the game interesting for long-time players while also giving free-to-play players an incentive to stick around."* Another player (Forum user ID: DJQuixo) added: *"I think Season Two (with new gaming stages) is a win. Better loot, different boss behavior, some of the levels have fewer waves (which I personally like) and novelty is great after all."*

By stimulating curiosity and maintaining a sense of novelty, the Interest Rejuvenation mechanism can facilitate the development of MGA. This echoes the findings of King and Delfabbro (2009), who suggested that new game quests and objectives induce longer game play time than intended by triggering players' desire to overcome the challenges, improve game skills, or complete the quests. More specifically, the emergence of these psychological states can be ascribed to the desire to excel in a game, which is underpinned by a hankering for increasingly powerful heroes, continual progression, and to gain status or influence within the in-game community (Vorderer et al. 2003). The desire for advancement or maintaining a player's status can induce uncontrolled spending so as to accelerate or maintain in-game progression (Xu et al. 2012).

2.4.5 Mutual Reinforcement between the Three Mechanisms

Finally, the findings of this study suggest the three mechanisms can mutually reinforce one another to amplify their joint effect. In particular, the Affective Socialization mechanism can strengthen the Intermittent Reinforcement mechanism by providing a trusted and intimate outlet for the players' heightened emotions from Chance-taking, which can increase the pleasure of winning and provide consolation for losing (Griffiths et al. 2004). To illustrate, on the online forum, there are multiple threads for players to post the results of their summons and celebrate with their alliance mates if they won and commiserate if they lost. A player (Forum user ID: GwynBleidd) described how the sense of camaraderie between alliance members offered some consolation when he experienced losses from Chance-taking: *"My alliance is painfully aware of my hatred for Renfeld (i.e., an undesired hero) because, in my (so far fruitless) quest for pulling Rigard (i.e., the desired hero) in Dark Elemental Summons, I always seem to pull Ren at least twice, along with the usual Priscas, Oberons and Tyrums (i.e., other undesired heroes)… The gaming gods are clearly vengeful ones, because they rewarded me with FOUR (a personal best!) of that clown-faced b****** AND STILL NO RIGARD… My alliance found the whole harrowing affair highly amusing. To this day I sometimes wake, screaming "Renfeld!", in the dead of night. Rigard continues to elude me"*.

Similarly, the Affective Socialization mechanism can reinforce the Interest Rejuvenation mechanism by enabling players to discuss new content and gaming strategies with other likeminded players within their alliance that they know and trust. This can enhance the players' enjoyment of the new content as these discussions enhance the sense of anticipation, speculate on its nature, and stimulate excitement (Goh and Wasko 2012). A player (Forum user ID Rigersa) provided an illustration of how she discusses inter-alliance war strategies with her alliance members to enhance her own enjoyment of this feature: *"Our alliance floats around 2,000th place and we are fine with that but are looking to develop our war strategy if there is*

truly any reason to. Wars are fun and we would like to win more than we lose. We are at just about exactly a 50% win rate over the last 60 wars. In essence, I am considering adopting a more careful, disciplined strategy that requires alliance members to be even more particular than they are right now about when they take their hits and against whom. It will undoubtedly create inconvenience but would also undoubtedly allow us to do better."

2.5 Discussion and Conclusion

By integrating the findings on the three mechanisms I uncovered, a theoretical model of how the characteristics of a mobile game can induce addiction is inductively derived to address the research question (refer to Figure 1). More specifically, the unique **Game-Related** (i.e., *Instantaneity*, *Perpetual Connectedness*, *Gameplay Simplicity*) and **Developmental Characteristics** (i.e., *Resource Constraints*, *Iterative Development*) of a mobile game may enable the presentation of a number of gaming features from which the underlying mechanisms of MGA arise. These features manifested in this case study in the forms of *Constrained*
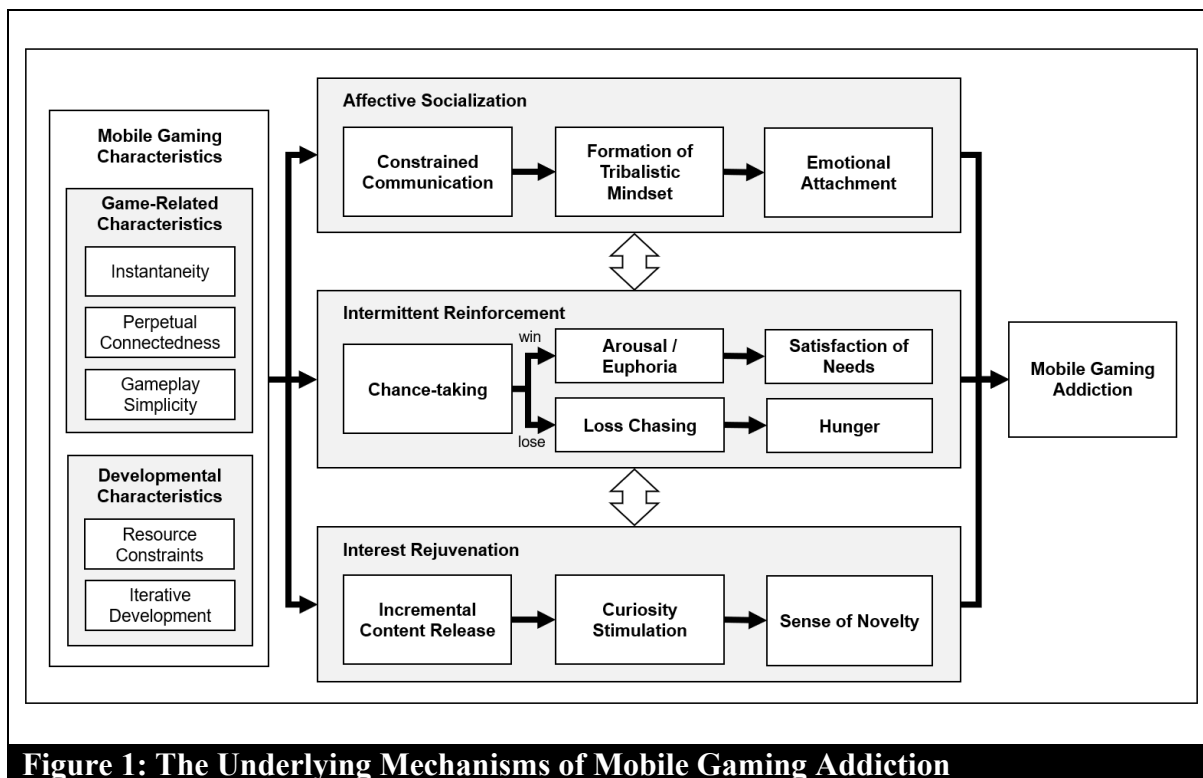
Figure 1: The Underlying Mechanisms of Mobile Gaming Addiction

Communication, *Chance-taking*, and *Incremental Content Release*, which underpin the (1) Affective Socialization, (2) Intermittent Reinforcement, and (3) Interest Rejuvenation mechanisms respectively.

Within the **Affective Socialization** mechanism, social networking tools can be made available in mobile games to allow the formation of collectives (i.e., alliances) and interactions between players (Cole and Griffiths 2007; Goh and Wasko 2012). But the findings of this study suggest that these tools can be deployed in a way to facilitate **Constrained Communication,** where free interactions with the other players in game is not allowed, except for the members of their own alliance. This form of interactions allow players to share their excitement and frustrations with an "in-group" of other players (see Brewer 1979, p. 308), and in tandem with having shared objectives, this could result in the **Formation of a Tribalistic Mindset**, and subsequently, a deeper **Emotional Attachment** to the members of the same in-group. These effects can foster MGA because a tribalistic mindset can make players feel a sense of social obligation to play the game until an in-game alliance objective is achieved, while avoiding social ostracism (Williams et al. 2000) within the alliance for not meeting those obligations. Moreover, Emotional Attachment can precipitate a stronger commitment to the game because players genuinely feel and care for their alliance members, which stem from interacting almost exclusively with them for a prolonged period (Junglas et al. 2013).

On the other hand, mobile games can also present an **Intermittent Reinforcement** mechanism that is similarly present in the context of gambling. With this mechanism, MGA can arise from **Chance-taking** (implemented as a "Gacha" or "Loot Box" feature) through two pathways, regardless of whether the player wins or lose. More specifically, when players win, they may experience **Arousal** or even **Euphoria**, and subsequently, the **Satisfaction of Needs**. This can foster MGA because Arousal and Euphoria reflect the uncertainty associated with monetary

risks, which increase the expectation of rewards and can make players psychologically obsessed with winning or reluctant to quit playing (Blaszczynski and Nower 2002). Conversely, when players lose, they may exhibit **Loss Chasing** behavior to sate their **Hunger** for in-game resources. This can give rise to MGA as well because players may not stop playing when they lose, but instead, play even longer and more frequently to achieve their desired outcome or recoup their perceived losses (Griffiths 1990).

Finally, data suggests an **Interest Rejuvenation** mechanism that while mobile games are rarely released as polished final products unlike traditional computer games, the **Incremental Content Release** may, in fact, play an important role in **Curiosity Stimulation** and providing a **Sense of Novelty**. With a constant stream of new resources, content and objectives released in frequent and bite-size doses, players will always have something to look forward to and they will never fully accomplish all the in-game objectives (King et al. 2015). Consequently, MGA may arise as players spend more to acquire the incrementally more desirable in-game resources that are constantly being released, as well as play more in an attempt to reach an ever-growing number of in-game targets. This drive may be motivated by a player's inherent desire to excel in a game, which can result in uncontrolled spending on the purchase of additional in-game resources to maintain or accelerate game progression (Xu et al. 2012).

Beyond the discrete effects of the three mechanisms, the theoretical model further suggests that the mechanisms may also reinforce the effects of one another to create a dangerous blend of compulsions. For instance, Affective Socialization can amplify Intermittent Reinforcement by providing an outlet for sharing the triumphs and tribulations from chance-taking (Griffiths et al. 2004), and allow a player to celebrate or commiserate with a perceived in-group (Rockloff and Dyer 2007). In a similar vein, Intermittent Reinforcement may augment Interest Rejuvenation by not allowing players to access the newly released in-game resources or content

outright, and instead heightening their anticipation and desire for them by subjecting access to a random draw (Griffiths 2018). Likewise, Affective Socialization can reinforce Interest Rejuvenation by allow players to discuss the new resources and content with their in-group, which can enhance the players' enhance the sense of anticipation and stimulate excitement surrounding these new releases (Goh and Wasko 2012).

2.5.1 Theoretical Implications

While mobile gaming has proven to be an unmitigated commercial success in the contemporary electronic gaming industry, its addictive properties and the mechanisms through which MGA arise, have not received adequate research attention to date (Sun et al. 2015). In being one of the earliest studies on the underlying mechanisms of MGA, this study has made a number of theoretical contributions. First, this study presents a nomological network that illustrates how certain game-related (i.e., instantaneity, perpetual connectedness, gameplay simplicity) and developmental (i.e., resource constraints, iterative development) characteristics of mobile games may give rise to three mechanisms that have the potential to induce MGA. The three mechanisms are the Affective Socialization, Intermittent Reinforcement, and Interest Rejuvenation mechanisms. By providing an in-depth view of how these mechanisms, each underpinned by a distinct feature of a mobile game, may give rise to MGA through their influence on the psychological states of gamers, I have developed a novel theoretical framework that can potentially guide future studies into the mechanisms of MGA in other contexts (e.g., other types of mobile games). In doing so, I believe that I have paved the way for a more holistic understanding of this increasingly prevalent social ill (Kwon et al. 2016), and made an important initial contribution to its treatment and mitigation.

Second, as indicated earlier, of the handful of existing studies on the topic, most of them have adopted a demand-side perspective by focusing on the personality traits (e.g., Billieux 2012;

Chen and Leung 2016) and gaming motivations (e.g., Sun et al. 2015) of mobile gaming addicts. At the same time, supply-side factors have been recognized as pivotal to inducing addiction in the context of traditional computer games (see King and Delfabbro 2009; King et al. 2011), but these factors have not been specifically explored in the context of mobile gaming. The ideas introduced in this study are thus an important contribution, as it provides a supply-side perspective of MGA to complement the existing demand-side view. In doing so, this study has not only addressed a salient gap in the literature (see Sun et al. 2015), and contributed to a more holistic understanding of the phenomenon, but it may also serve as a catalyst for further research into the supply-side factors of MGA. And as this supply-side perspective of MGA becomes more developed, the interactions between the demand- and supply-side factors of MGA may be a promising avenue for future research as well.

Third, this study presents an important conceptual innovation as it reveals mobile gaming to be a unique and powerful blend of gambling (i.e., through Chance-taking), social networking (i.e., through Constrained Communication) and traditional computer gaming (i.e., Incremental Content Release). In particular, while mobile gaming is not exactly like each of these contexts, it combines some of their most addictive elements to present a package of potent and mutually reinforcing forces that may arguably have the potential to foster more severe addictive behaviors (Chen and Leung 2016). The in-depth explanation of how the three mechanisms introduced in this study can be amalgamated to strengthen one another is thus an important contribution, as it suggests that in trying to understand how MGA arises, the combined effects of all three mechanisms must be considered and accounted for together.

Finally, by examining gaming addiction in the specific context of mobile games, this study has revealed the need for a more nuanced view of the phenomenon. In particular, I contend that I may have uncovered a new form of gaming addiction that is profoundly influenced by the

characteristics that are unique to mobile gaming. For instance, this study suggests that the constant and easy access to a mobile game afforded by the characteristics of Instantaneity (Ko et al. 2009) and Perpetual Connectedness (Park et al. 2014) can make an Intermittent Reinforcement mechanism all the more powerful (Griffiths 2018). In revealing the influence of these characteristics of mobile gaming on the resultant mechanisms and addiction, I believe that the presented theoretical model has introduced greater variety and sophistication to the conceptualization of gaming addiction. This may, in turn, pave the way for future supply-side studies seeking to explore the different characteristics, functions, and content of mobile games, as well as their influence on the players, which would advance our knowledge of how MGA arises.

2.5.2 Limitations and Future Research

This study is not without its limitations. First, although I uncovered five mobile gaming characteristics and three mechanisms that induce MGA, we must acknowledge that other variations are possible. As the characteristics, features, content, and even the types of games can take on a near-infinite array of possible forms, the mechanisms captured by the model is surely non-exhaustive, and many others may be possible. And while it must be acknowledged that it is impossible to capture all possible configurations of pathways to MGA within a single study, I contend that the model can nevertheless serve as a starting point of an important line of inquiry, as well as a baseline theory for future supply-side studies on MGA to build upon. In any case, future studies can attempt to replicate my investigation in the context of other types of mobile games. The characteristics, features and mechanisms of these games, which may not be present in this study, would certainly be a fruitful avenue for future research.

A second limitation is that although studies based on a single case are a "typical and legitimate endeavor" (Lee and Baskerville 2003, p. 231), a common criticism of the single case research

method in qualitative research is the issue of generalizability (Walsham 2006). While we must acknowledge that statistical generalization is impossible because of the singular context of this study, I contend that this study invokes the principles of analytic generalization (see Silva and Hirschheim 2007) or what has been described as "generalizing from description to theory" (Lee and Baskerville 2003, p. 235). This is because the model from this study is grounded in the empirical reality of the case of E&P and corroborated by numerous prior studies in the mobile gaming and gaming addiction literatures. In any case, future research can be directed at statistically validating the propositions of the model of this study, so that the boundary conditions of this study can be better defined.

2.5.3 Implications for Practice

Beyond its theoretical contributions, I contend that this study also has important practical implications. First, in specifying the constituent elements of the underlying mechanisms and revealing their influence on the psychological states of gamers, this study can help gaming addicts, as well as the people (e.g., family and loved ones) and institutions (e.g., rehab centers) who are interested in helping them overcome their addiction to ensure that effective and appropriate interventions are applied. For instance, according to the theoretical model from this study, one of the aspects of MGA uncovered in our study stems from Intermittent Reinforcement. This study suggests that chance-taking can resemble gambling where players tend to overestimate their chances and believe they can control luck (Griffiths 2018). With an awareness of how this mechanism works, we may be able to design interventions to dull the sense of arousal or euphoria that stems from winning, or rationalize loss-chasing behaviors when the player is losing. This could curb the potency of the focal mechanism, and subsequently, help the gamers avoid the psychological states and pathological behaviors associated with MGA (see Griffiths 2005).

Second, this study can also provide prescriptions for policymakers who are trying to regulate mobile gaming and looking for ways in which they can mitigate the negative social implications of MGA. More specifically, this study suggests that arousal/euphoria, satisfaction of needs, loss chasing, and hunger are the psychological impacts from chance-taking that can induce uncontrolled spending and addiction. This suggests that policymakers can step into curb arousal/euphoria and loss chasing by implementing regulations, such as capping and limiting an individual's monthly spending on mobile games to prevent loss chasing. For instance, as practiced currently by some governments and gaming platforms (see Craddock 2019), regulations may be put in place that allow players to spend only a limited amount on gaming per month. Policymakers can also mandate the use of regular notifications to remind players to take a break from continuous play, or impose a hard limit on the duration of play.

CHAPTER 3: THE NATURE AND ACCRUAL OF DIGITAL DEBT

3.1 Introduction

Digital debt is currently conceptualized as a reflection of an organization's cumulative buildup of the combination of technical and informational debt related to the maintenance and evolvability of a business that represent performance risks in an organization's work processes (Rolland et al. 2018). Of its two sub-components, technical debt refers to "the expected cost or effort entailed" in creating shortcuts during technical redesign, component upgrading, or wholesale replacement of a system architecture (Woodard et al. 2013, p. 540), while informational debt refers to the content inconsistencies and gaps embedded in digital infrastructures and work processes (Rolland et al. 2018; Seaman and Guo 2011). Prior studies have estimated that the value of technical debt is around US$3.61 million for a typical software application with 100,000 lines of code (Curtis et al. 2012). Moreover, a recent McKinsey and Company report suggests that 60% of the CIOs it surveyed identified that their organization's digital debt had increased over the past three years (Dalal et al. 2020), while a recent Accenture report suggests that 70% of their agencies do not have a fully-integrated approach to measure and manage their digital debt (McClure 2018). Although beneficial when appropriately managed, digital debt may nevertheless have a potential "dark side" because the pervasiveness of digital debt will inevitably have profound adverse implications for organizations (Burden et al. 2018), which may include significant financial consequences (Curtis et al. 2012), higher business risk exposure, greater chance of causing project losses, and severe system failures in the future (Ramasubbu and Kemerer 2016). Despite its significant impacts, many organizations struggle to manage digital debt, and this difficulty is symptomatic of a lack of knowledge on debt management.

Despite the increasing prevalence of these issues, existing studies on digital debt have primarily centered on conceptualizing technical debt, which is merely one of its sub-components (e.g., Tom et al. 2013; Woodard et al. 2013). The concept of digital debt is a recent introduction (Rolland et al. 2018) and, therefore, the current conceptualization of the phenomenon may not be sufficiently encompassing to reveal its entire scope. For example, not matching the right people to the appropriate IT job or project may create additional efforts and costs to fix problems in the future (Casey 2020), which implies a form of digital debt. However, according to prior research (see e.g., Fowler 2009; Rolland et al. 2018; Tom et al. 2013), this is neither a technical debt because it is not associated with a service, network, or device layer (Yoo et al. 2010a), nor an informational debt because it is not related to a content layer (Yoo et al. 2010a). Without detailed studies of the nature of digital debt, it would be difficult to provide indications to the ways of managing them (McClure 2018).

Further, while a handful of studies have looked at the causes of technical debt (e.g., Banker et al. 2020; Kruchten et al. 2012) and consequences of digital debt, they have paid considerably less attention to the mechanisms through which digital debt is accrued. Kruchten et al. (2013, p. 51) argued that a "better understanding of the concept of technical debt, and how to approach it, both from a theoretical and a practical perspective is necessary to advance its state of the art and practice." Addressing these knowledge gaps is important because it may reveal the specific mechanisms of accumulating digital debt and generate insights into preventing the accrual of new digital debt, or reducing previously accumulated digital debt, and consequently, minimizing its adverse impacts.

Accordingly, the objective of this paper is to investigate the nature and process of digital debt accrual. More specifically, the study is grounded in empirical evidence obtained from the case of Fintech Platform Company (FPC – a pseudonym). This organization has undertaken a

variety of systems development projects for a vast array of small and medium enterprises (SMEs), which are more likely to accrue digital debt due to their resource constraints (Casey 2020). In doing so, the aim of this study is twofold. First, I will develop and present a theoretical framework that sheds light on how companies accrue digital debt. Second, beyond its academic implications, this study also aims to provide indications to practice on the appropriate interventions for mitigating the accrued digital debt, for example, by understanding the debt accrual process and developing guidelines for minimizing its adverse implications. Accordingly, this study aims to address the following research questions: (1) "What is digital debt (i.e., its nature)?" and (2) "How is digital debt accrued (i.e., its process)?".

3.2 Literature Review

3.2.1 Existing Research on Digital Debt

The extant literature defines the notion of digital debt as an offshoot of the concept of technical debt, that has long been used in software engineering (Cunningham 1992). A key point of difference between the two is that digital debt involves a broader concept that encompasses both technical and informational debt (Rolland et al. 2018). In particular, technical debt is incurred when creating shortcuts during technical redesign, component upgrading, or wholesale replacement of an existing system configuration to a layered modular architecture (Woodard et al. 2013, p. 540). This often results in setting long-term system objectives aside and, instead, "making do" with a low-quality system for time and cost reduction in the short-term at the expense of accumulating more unpredictable constraints on future system maintenance, evolvability, and modification (Guo et al. 2016). On the other hand, informational debt is incurred when duplicate or inconsistent information is inappropriately maintained across different systems over many years (Rolland et al. 2018; Seaman and Guo 2011).

The cumulative body of work on digital debt can be categorized into three major streams (see Table 6). The first stream is on the **conceptualization of technical debt**, which focuses on classifying this component of digital debt in multiple categories based on its characteristics. For example, technical debt has been categorized into four characteristics – strategic, tactical, incremental, and inadvertent (Tom et al. 2013), and four quadrants – deliberate, inadvertent, reckless, and prudent (Fowler 2009). These classifications tend to emphasize the groups of scenarios that are likely to happen. However, these studies tend to focus more on distinguishing whether a debt is acquired consciously (e.g., strategic, deliberate) or unconsciously (e.g., inadvertent). The former relates to when a firm considers the potential ramifications beforehand and identifies possible technical debt before taking on the debt, whereas the latter relates to when a firm identifies debt after taking some time to learn about a project, often due to lack of knowledge on what the best design approach should be (Fowler 2009; Tom et al. 2013). In addition, technical debt has been associated with the four different states of a firm – option-constrained, debt-constrained, low-quality, and high-quality states, in which each depends on a firm's debt-reducing or option-creating design moves (see Woodard et al. 2013). An option refers to an opportunity to invest in new technical and informational features that increase the system's value for an organization's work processes (Sambamurthy et al. 2003).

The second stream is on the **consequences of digital debt**, which emphasize the significant implications of digital debt for organizations. An initial acquirement of digital debt is not necessarily a serious problem if the debt is repaid promptly or if the software is deployed for short-term use (Ramasubbu and Kemerer 2014). However, when this debt is not paid off promptly, or a system remains running longer than intended, there can be numerous unintended consequences (Guo and Seaman 2011; Ramasubbu and Kemerer 2016). Failure to manage digital debt can adversely influence a software system's long-term quality, maintainability, and evolvability (Rolland et al. 2018) by incurring expensive maintenance cost (Curtis et al. 2012),

Table 6: Selected Studies on Digital Debt	
Source	**Key Arguments/Prescriptions/Findings**
Conceptualization of Technical Debt	
Fowler (2009)	Each dimension in four quadrants – deliberate/inadvertent and reckless/prudent – indicates the characteristics of technical debt. Prudent and deliberate debt are identified before taking on a debt and the team considers the potential ramifications beforehand, and reckless debt is incurred when the team decides to execute quick and dirty codes because they are under the project time pressure. Inadvertent debt is realized after taking some time on learning a project, due to lack of knowledge.
Kruchten et al. (2012)	Technical debt is associated with maintainability and quality issues that may involve the causes such as carelessness and poor processes, and with technological gaps and evolvability issues that may involve the causes of schedule pressure and rapid delivery without much consideration or systematic testing. It may also incur in response to software aging and evolution.
Woodard et al. (2013)	Four different states of a firm consist of 1) an option-constrained, shortages of design options in the current architecture, 2) a debt-constrained, the abundance of design options but the ability to execute the embedded options is restricted by the high technical debt, 3) a low-quality, having few options embedded in current designs and being restricted by the high exercising cost, and 4) a high-quality state, exploiting market opportunities and pursuing innovation with speed and scale with a wide range of options and low debt.
Tom et al. (2013)	Four types of technical debt consist of 1) strategic, when trading off long-term benefits for short-term benefits, 2) tactical, when trading off the deferral of work for rapidly adding functionality to meet the immediate market demand, 3) incremental, which result from numerous, small shortcuts that are hard to track and manage, and 4) inadvertent debt, that is accrued unintentionally, attributed to ignorance and oversight, such as a lack of knowledge on anticipating the impacts of decisions.
Consequences of Digital Debt	
Guo and Seaman (2011)	Technical debt carries uncertainty about whether it has the interest, which refers to the extra maintenance effort that should be paid off in the future often due to inappropriate or inconsiderate design choices that are made present. In this respect, technical debt creates a risk in software maintenance and raises a question of which debt can be deferred and when it should be paid off.
Ramasubbu and Kemerer (2014)	A higher-debt strategy, such as rapid modification of system features, involves poor software quality, but this brings about short-term business benefits, such as enhancement in customer satisfaction due to faster fulfilment of needs. A lower-debt strategy may result in poor customer satisfaction but bring about long-term high quality that may improve the ability to add and modify features faster during the later stage of the product lifecycle.
Ramasubbu and Kemerer (2016)	The presence of technical debt can result in more expensive maintenance activities, higher business risk exposure, and greater chance of causing project losses. Although design shortcuts may achieve short-term business benefits, technical debt may lead to severe system failures in the future, which decrease the system reliability and make software maintenance imperfect.
Rolland et al. (2018)	Digital debt accumulates maintenance obligations and reduces the evolvability of the system and the digital infrastructure. Identifying, developing, and realizing digital options are intertwined with planting, evaluating, and resolving digital debt. These complex interactions involve tensions in which the accumulated digital debt may hinder the realization and development of digital options.
Management of Digital Debt	
Brown et al. (2010)	As part of a repayment approach, the properties to pay attention to involve visibility of technical debt, foreseeable and uncertain impacts, debt accretion, related environment, and intentional and unintentional debt.
Marinescu (2012)	The goal of assessing technical debt is to increase the visibility of design flaws. The assessment involves selection of a set of design flaws, detection of each design flaw, measurement of the negative impacts of each identified flaw instance, and computation of the design quality status of a system by considering the ramifications of all identified flaws.
Li et al. (2015)	The technical debt management activities involve debt identification, measurement, and repayment. Identification detects and distinguishes intentional and unintentional technical decisions. Measurement estimates and quantifies the cost and benefit of identified debt. Repayment mitigates debt through making changes to or evolving the existing architecture of a system.
Guo et al. (2016)	Technical debt management process consists of debt identification, measurement, and monitoring. Identification involves constructing the technical debt list, containing debt items, each of which represents a delayed task and characterizes what the technical debt is, who is responsible, when it was detected, where it is located, and estimates of the principal and the interest. Measurement involves estimating and quantifying the principal and the interest. Monitoring involves making decisions on what and when debt items need to be paid or deferred.

deteriorating the pace of software development, and crippling the ability to meet consumer demands (Kruchten et al. 2019). In particular, a firm with high technical debt tends to be less reliable and more error and failure prone, and is likely to frequently take design shortcuts, leading to more difficult and costly maintenance tasks and structural complexity (Ramasubbu and Kemerer 2016).

The third stream is on the **management of digital debt** that is primarily centered on the means of debt mitigation. A number of scholars have discussed technical debt identification, measurement, monitoring (Guo et al. 2016), and repayment (Li et al. 2015) as steps or activities to manage debt. Identification refers to taking stock of technical debt, which contains delayed tasks associated with future maintenance problems and the specifications of each technical debt item, such as what the technical debt is, who is responsible, when it was detected, and where it is located (Guo et al. 2016). Measurement refers to estimating the amount of additional system maintenance and modification efforts needed for future development fixes, while monitoring refers to making decisions on which and when debt items need to be paid or deferred (Guo et al. 2016). Finally, repayment refers to mitigating technical debt through making changes to or replacing the existing design or architecture of a software system (Li et al. 2015). The primary properties to pay attention to during debt management are the visibility of debt, foreseeable and uncertain impacts, and the related environment (Brown et al. 2010). This stream of research helps us understand that the goal of assessing technical debt as part of its management process should be increasing the visibility of design flaws (Marinescu 2012).

Notwithstanding the contributions of previous studies, a closer examination of the existing literature reveals two important research gaps (Alvesson and Sandberg 2011). First, although the extant literature demonstrates an awareness of the conceptualization of digital debt (Rolland et al. 2018), much of the present discourse is centered on technical debt (e.g., Fowler 2009; Tom et al. 2013; Woodard et al. 2013). Digital debt has only been recently introduced in the

literature, and technical and informational debt have been conceptualized as its sub-components (Rolland et al. 2018). Yet, it is still apparent that this conceptualization is incomplete. For example, an inappropriate matching of personnel to jobs/projects when resource-constrained firms are forced to work with resources at hand will create risks and additional costs (Casey 2020); however, this is neither a technical nor informational debt because it is not associated with a service, network, or device, nor the content layer (Yoo et al. 2010a). Without an adequate understanding of the scope and nature of digital debt, it will be difficult to manage or account for them holistically (McClure 2018). The fact that digital debt cannot be successfully managed (McClure 2018) in isolation from the understanding of its exact nature means that a dedicated study on the broader scope of digital debt is worthy of exploration (Kruchten et al. 2013).

Second, our knowledge on how digital debt is accrued remains limited as this process has not been extensively studied to date. An exception is the study by Kruchten et al. (2012), who identified the causes of technical debt, such as schedule pressure, carelessness, lack of education, and poor processes, as well as resource constraints (Lim et al. 2012) and industry competition (Banker et al. 2020). However, these triggering factors may only provide insights on what to avoid in order to avoid digital debt, while the effects of these factors and how they result in digital debt have not been adequately studied. Alves et al. (2016, p. 118) argued that "it is necessary to conduct further studies in the area to investigate new techniques and tools that could support developers with the control of technical debt." As such, shifting the focus to a process perspective may contribute a more nuanced view of the specific trajectory of digital debt accrual, and may help us provide indications on how companies, which may already have acquired significant debt, can mitigate their digital debt. To address these research gaps, the aim is to conduct an in-depth investigation into the nature and accrual of digital debt. In the following sections, I will describe our research approach, and the findings from this study.

3.3 Research Method

The case research method was adopted because its strengths lie in examining processes (Rynes and Gephart 2004) and addressing 'how' research questions (Walsham 1995). The research question of this study is a 'how' question that delves into the process of digital debt accrual. As the accrual of digital debt consists of a technological and a business dimension (Wagner et al. 2010; Xue et al. 2005), the multi-dimensional complexity of the phenomenon makes objective approaches to research inherently difficult. Therefore, it may be more suitable to examine the phenomenon by interpreting the shared understanding of the relevant stakeholders (Klein and Myers 1999).

Based on my research questions, two criteria formed the basis for case selection. First, in order to increase the potential depth and variety of theorizing, the selected case organization should have undertaken a variety of systems development projects. Working on various projects with a great number of different client companies would expose the organization to a variety of ways, with varying results, of accruing digital debt, so as to potentially experience different ways of accruing digital debt. A corollary of this criterion was that I needed to investigate multiple iterations of the incurrence of digital debt accrual at various client companies. Second, I needed a case organization that had implemented projects for multiple resource-constrained clients, leading to the likelihood of accruing digital debt (Casey 2020; Ramasubbu and Kemerer 2016), and thus allowing us to examine the full-blown impacts of the accumulated digital debt on an organization. As such, the case of FPC was particularly appropriate and this made FPC a revelatory case (Sarker et al. 2012) for the purpose this study.

FPC, founded in 2006, is a software vendor based in Seoul, South Korea, that has delivered its technical solutions to more than 100 organizations over the past decade. It is currently providing system maintenance and management services to more than 70 client organizations.

FPC aims to strengthen its clients' competitiveness by providing advanced financial solutions and professional IT services. Its main clients are SMEs, such as financial institutions, loan companies and institutions, loan brokerage companies, and credit management companies.

FPC's services can be classified into three main categories: 1) consulting, 2) solutions, such as finance solutions, peer-to-peer (P2P) financial solutions, security solutions, and mobile solutions, and 3) new IT system development, management, operation, and maintenance. More specifically, first, FPC offers consulting services in terms of strategy consulting, process improvement, and the implementation of strategies. Second, FPC provides four types of solutions: a) finance solutions that encompasses sales, screening, loan execution, and bond management, b) P2P financial solutions that include investor management, and user interface and user experience (UI/UX) website development, c) security solutions that provide an interoperable security system for user information protection, hacking prevention, and database encryption, and d) mobile solutions for safe and user-friendly mobile financial services applications. Third, FPC serves its clients with system and software configuration, development, integration, maintenance, and upgrading.

3.3.1 Data Collection

The study was designed with two main phases: a preparatory phase and a fieldwork phase. The aim of the preparatory phase was to collect and analyze data from a variety of secondary sources in order to obtain an overall understanding of FPC and its services. The focus of the subsequent fieldwork phase was to gather primary data that are specific to our research question and explore in-depth the nature and process of digital debt accrual (Pan and Tan 2011). Interviews formed the primary source of data (Myers and Newman 2007; Walsham 2006) and a total of 11 unique informants were interviewed – some repeatedly. In total, 17 interviews were conducted. Using Chain referral sampling, I identified and interviewed informants made

up of representatives of FPC's top management team, the strategy and planning team, the research and development team, as well as its business administration team (refer to Appendix B.1). These informants were selected on the basis that they were the key decision makers or members of a particular stakeholder group, they were well-placed to answer the interview questions I formulated in an emergent manner across the various iterations of data collection and analysis (as will be described later), and they were able to provide a sufficient and first-hand account of the process of digital debt accrual.

The interviews were conducted with the help of a semi-structured interview guide (Myers and Newman 2007; see Appendix B.2 for a sample) that contained a standard set of questions on digital debt accrual, the system development process, demands and limitations of client companies, as well as the implementation of projects. There were also specific questions tailored for each informant based on their role (e.g., informants, who were system developers, were asked how system design decisions were made and implemented, and how certain decisions created additional technical obligations). This approach is more flexible than an explanatory case study that seeks to validate pre-established hypotheses (Ferlie et al. 2005), and more able to strike a balance between the pure induction and the pragmatism of an earlier structure (Langley 1999). The interviews took an average of 60 minutes, were digitally recorded, and subsequently transcribed for data analysis.

3.3.2 Data Analysis

To take full advantage of the flexibility that the case research method affords, data analysis was conducted concurrently with data collection. After obtaining an overview of the phenomenon from the initial interviews, I adopted a temporal bracketing strategy (Langley 1999) and categorized the array of events, activities, initiatives, and decisions that transpired at FPC into the four stages of digital debt accrual (as will be described later). The purpose of

the temporal bracketing strategy was to create a logical structure and a frame of reference to organize the subsequent data collected (Langley 1999).

The data collected were then coded (see example in Appendix B.3) using a mix of open, selective, and theoretical coding (see Glaser 1992; Holton 2010). First, open coding was used to assign conceptual labels to excerpts from the data to form first-order concepts (e.g., "development of systems was uncoordinated"). Selective coding was then used to categorize the first-order concepts into second-order themes (e.g., "Piecemeal Development"), while theoretical coding was used to abstract the second-order themes into aggregate dimensions (e.g., "stages of digital debt accrual"). Whenever new concepts, themes, or dimensions emerged that challenged the existing schema (Dacin et al. 2010a), the schema was modified (i.e., concepts, themes, or dimensions were added, replaced, or removed) and the process of coding was restarted (Walsham 2006).

Moreover, when changes to the emergent theory were particularly significant, I used narrative and visual mapping strategies to summarize and validate the findings (Langley 1999). The narrative strategy entailed developing a textual description of the key dimensions and process, which emerged in interviews, that facilitated digital debt accrual. On the other hand, the visual mapping strategy involved documenting the trajectory of digital debt accrual during systems development in a series of conceptual diagrams. Beyond serving as summary devices, both were verified repeatedly with some of the informants to validate the interpretation of the informants' accounts (Klein and Myers 1999). The process of iterating between data, analysis, and theory development and juxtaposing with the existing literature continued until the state of theoretical saturation was reached (Glaser and Strauss 1967).

3.4 Findings

The findings from this study of FPC suggest that there are multiple triggers that provide the spark to initiate system development, and multiple catalytic conditions that are particularly conducive to digital debt accrual. The process of digital debt accrual progresses along four stages: (1) Coerced Outsourcing, (2) Design Economization, (3) Piecemeal Development, and (4) Redundant Concurrency. Each stage consists of activities that result in a different form of digital debt respectively: (1) Capability Debt, (2) Functionality Debt, (3) Developmental Debt, and (4) Technical Debt. The acquired digital debt, in turn, fosters more debt accumulation to form a vicious cycle of digital debt accrual that exacerbates the impacts of debt on companies. I illustrate these concepts with evidence from this case study of FPC in the following subsections before presenting an integrated theoretical framework of the process of digital debt accrual.

3.4.1 Triggers

Our findings reveal that a number of triggers provide the spark to initiate new system development. The first is **Paradigm Shifts**, where critical changes in the application of IT in the business environment (Tapscott and Caston 1993) create a significant technological gap between the incumbent firms and the disruptors (Christensen et al. 2018). Many of informants indicated that once the current technology had become less efficient than the new technology, FPC's client companies were coerced to adopt the new technology. Given the resource-constrained state of its clients, FPC's clients' decisions were often made based on trading off long-term benefits for short-term cost considerations, which resulted in creating future obligations (Tom et al. 2013). The Managing Director of FPC [D1] explained:

> *New technology is not advanced gradually in a linear shape, but it suddenly makes a quantum jump at a single point in time. This transitional period is called paradigm shifts. Businesses with IT capabilities assimilate new technologies in operation, whereas those without requisite IT capabilities struggle with lack of capabilities.*

The second trigger is **Mimetic Pressures**, in which top management succumbs to mimicking the decisions and actions of its successful competitors (adapted from DiMaggio and Powell 1983) in assimilating new digital technology in its system (Liang et al. 2007), resulting in ad-hoc development decisions. Retaining the status quo of client companies would impose high risks on them because mainstream digital savvy consumers were likely to switch to more successful competitors (Christensen et al. 2015). While many organizations follow an organizational transformation strategy to reengineer, improve, and optimize business processes because of the verified success of such an approach (Liang and Xue 2004), my findings are in line with the study of Woodard et al. (2013), who suggested that existing component upgrading, technical redesign, or replacement of an existing configuration with modern system architecture may create technical obligations. Senior Manager B of the Strategy and Planning (S&P) Department [S2] explained:

> *Companies benchmark successful competitors that applied new digital technology in their systems. Before following the cases of the new technology application, it is important to check the company's system reliability and effectiveness, otherwise the firm may result in failures and significant financial losses.*

Third, **Advances in IT** can precipitate business process redesign to counter the problems of poor work efficiency, time-consuming work processes, work overload, and increased consumer complaints. While digital technology enables firms to generate new forms of digital offerings, it pushes incumbent firms to redesign business offerings and processes (Kahre et al. 2017). However, if a company is in a resource-constrained state, it may sometimes undertake hasty system development fixes. This is in line with the work of Kruchten et al. (2012), who indicated that debt is incurred when the context evolves, such as when software aging and industry transformation happens. Senior Manager A of the S&P Department [S1] explained:

> *Our client companies request the development of a next generation system when they experience serious technical limitations with the existing system, when they acknowledge the gap between the existing and the next generation systems, or when the next generation system is judged to be more efficient in terms of money and time.*

Moreover, my findings suggest that a number of catalytic conditions influenced the process of digital debt accrual (see Table 7) amongst FPC's client companies. The first is **Organizational Inertia**, which refers to "attachment to, and persistence in, using an incumbent system (i.e., the status quo), even if there are better alternatives or incentives to change" (adapted from Polites and Karahanna 2012, p. 24). The second is **Strategic Myopia**, which refers to an organization's limited foresight (Weick 2012) associated with failures to adapt to changing market needs by overemphasizing the exploitation of existing resources ahead of the exploration of digital innovation (adapted from Park et al. 2020). Its risks of unintended consequences can largely impact business performance, culture, and agility (Weick 2012). The third is **Resource Constraints**, which is described as an over-constrained situation for developers that blocks investment in reducing digital debt and forces them to abandon options (Woodard et al. 2013). In particular, developers who work under a resource constrained condition typically face long working hours and challenging expectations. The fourth is **Systematic Incomprehension**, which refers to the state in which the business owners and the technical experts suffer from large asymmetries of knowledge between the objectives and plans of software desired benefits and the technical design and implementation (adapted from Tiwana and McLean 2005).

Collectively, my findings suggest that these triggers precipitate new system development and catalytic conditions form a hotbed for digital debt accrual, which is sparked in the presence of the four stages that I will discuss in the following stream of reporting. The interaction of triggers, catalytic conditions, and the four stages can be the reason why firms may be forced to acquire digital debt. Moreover, my findings suggest that the influence of catalytic conditions is not restricted to a single stage of digital debt accrual (to be elaborated in the following subsections), but rather across all stages.

3.4.2 Stage 1: Coerced Outsourcing

Driven by the triggers, FPC's client companies were coerced into replacing their legacy systems with next generation systems even if they were resource-constrained, as the heightened level of technology-enabled operational effectiveness and efficiency were crucial to customer acquisition and the generation of profits. A legacy system refers to an information system that is based on outdated systems or technologies but is critical to day-to-day operations (Seacord et al. 2003), whereas a next generation system refers to an information system that is based on advanced technologies that reduce transaction costs and influence global trade growth (Bughin 2019).

FPC's client companies' legacy systems were well-established for optimal operation with existing customers, thus indicating that their systems were deeply entrenched in their existing infrastructure and associated work processes. A company that is committed to its legacy system is often rigid to change (Andriole 2017) and relies on work processes that cannot easily be reconfigured (Kohli and Johnson 2011). As it became clear that systems development entailed a long and cumbersome process and required significant organizational effort and investment of resources (Chesbrough 2003), the resource-constrained clients, either with poor IT performance or no dedicated IT department, were coerced into outsourcing system development. I call this stage **Coerced Outsourcing**, which is adapted from the notion of IT outsourcing, defined as "the significant contribution by external vendors of the physical and/or human resources associated with the entire or specific components of the IT infrastructure in the user (i.e., client) organization" (Loh and Venkatraman 1992, p. 338), but in this case, the company is coerced into outsourcing. This is in line with the review work of Lacity et al. (2009), who indicated that client firms with poor financial, business, and IT performance are

more likely to outsource IT work. The Analyst of the Research and Development (R&D) Department [A4] explained:

> *Clients are forced to outsource their systems development when they have no (or lack of) experience or have insufficient developers and human resources.*

Given clients are coerced into outsourcing as they cannot develop systems in-house, Coerced Outsourcing generates a new form of digital debt related to lack of capabilities. I call this **Capability Debt**, which I define as a client's inability to acquire new IT capabilities because a software vendor takes over systems development work and the vendor may not train client companies in development skills. That is, the client company may not acquire new capabilities simply by outsourcing its project. This, in turn, continuously manifests in having a lack of capabilities. While outsourcing reduces the risk of project failure (Boudreau 2012), Capability Debt may ultimately hinder the clients from acquiring in-house digital capabilities and confine them to traditional work processes. The Managing Director [D1] explained:

> *One of the client companies without an IT department outsourced their system development. The owner did not have IT background, so he had to make decisions without technical knowledge.*

Moreover, although some of FPC's client companies had an IT department, catalytic conditions constrained the firms from acquiring new capabilities (refer to Table 7). For example, these resource constrained firms tended not to slow down business activities in exchange for allocating new technology training time to IT developers. Hence, when these firms encountered projects that required new capabilities, they needed to select between hiring new developers with new skill sets, allocating longer work hours to existing developers, or outsourcing projects. The expansion of an IT department would incur additional expenses, but the creation of work overload would also foster resignation from the existing developers. Therefore, these firms would be continuously coerced into outsourcing new technology assimilation projects. In line with my findings, Hess et al. (2016) indicated that the acquisition of competencies needed for digital transformation is often constrained by the limited ability to allocate financial resources

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Table 7: Sample Coding Table of Catalytic Conditions	
Catalytic Conditions	Sample Interview Quote [Source]
Stage 1: Coerced Outsourcing	
Organizational Inertia	*"Many developers are attached to a traditional waterfall approach. Investment in new technology is part of production, but business owners focus more on short-term profits. Developers need to learn about new technology and improve their acceptability, but they don't have time for that as the firm often prioritizes imminent profits."* [D1: Managing Director]
Strategic Myopia	*"When we need to acquire or ask for requisite IT capabilities, we struggle if the decision maker(s) have a lack of knowledge on IT or are not aware of the importance of IT."* [S4: Senior Manager D of S&P]
Resource Constraints	*"When a client company does not have experience in software development or it does not have sufficient human resources, it may outsource its project."* [A4: Analyst of R&D]
Systematic Incomprehension	*"The biggest difficulty comes from a gap in understanding the nature of work between the involved working groups. Sufficient conversation between the involved personnel is the key to resolving problems."* [A3: Associate of R&D]
Stage 2: Design Economization	
Organizational Inertia	*"Release of new technology doesn't immediately impact the developers and the company. We review the new available service and observe the market response, but we do not respond proactively. We are reluctant to take the new technology in business operations straight away and instead we wait for the technology to be verified."* [S1: Senior Manager A of S&P]
Strategic Myopia	*"In order to acquire new technology, the company needs to provide financial support for individuals' (i.e., developers) learning and prepare alternatives for not having enough trained developers. Individuals should be proactive in learning about new, requisite technology."* [S1: Senior Manager A of S&P]
Resource Constraints	*"Platform design should maximize efficiency, but due to schedule pressure and budget limitations, the mobilization of human resources may result in wasting time and administrative work."* [S2: Senior Manager B of S&P]
Systematic Incomprehension	*"If a decision maker or a project owner has a lack knowledge on IT expertise, we expend significant efforts to make them understand the technical knowledge. We consider the ways to communicate from their perspective and seek understanding from those who do not have such knowledge."* [S1: Senior Manager A of S&P]
Stage 3: Piecemeal Development	
Organizational Inertia	*"Sometimes, some features are released first in line with a client's business schedule. I hate this because I have to release and inevitably change the operating system before it fits into the whole architecture. This is very painful, but when your supervisor asks you, you have to do it whether you like it or not."* [S3: Senior Manager C of S&P]
Strategic Myopia	*"When certain features are released first due to the client's impending business deadline, this does not fit with the entire system design. Developers need to fix the system configuration later again."* [S3: Senior Manager C of S&P]
Resource Constraints	*"Platform development requires massive amount of money. Companies with limited budget cannot develop all features from the start."* [D1: Managing Director]
Systematic Incomprehension	*"Explanation and persuasion should be accompanied when we pursue IT related work with clients and business units. The briefing session aims to convince them and seek understanding of the project feasibility and work efficiency from them."* [S2: Senior Manager B of S&P]
Stage 4: Redundant Concurrency	
Organizational Inertia	*"Some of the most difficult things include resistance of the involved personnel and the doubts about efficiency after the changes are made."* [A1: Associate of S&P]
Strategic Myopia	*"When applying a new technology, the results often turn out differently from the expectation. IT developers can hide codes to come back later to fix them. Since this is a technical side, other departments often don't recognize this."* [D1: Managing Director]
Resource Constraints	*"Dual systems management of both legacy and the next generation systems is burdensome due to additional allocated personnel and costs. If a company doesn't have enough in-house personnel, it is common to seek temporary support from other roles or deploy external personnel."* [A2: Associate of BA]
Systematic Incomprehension	*"The technical difference between the legacy and next generation system can act as work stress when wrong technology is applied, human error occurs, or additional learning is required. We need to differentiate the personnel between the legacy and the new system, analyse the system differences through mutual communication, and organize training."* [A2: Associate of BA]

to training programs that help foster the necessary digital skill set and mindset among existing staff.

3.4.3 Stage 2: Design Economization

Prior to systems development in FPC, client companies initially issued a request for proposal (RFP) to the company. The RFP included business objectives, preliminary requirements for system design and development, specifications of demands, and contract deadline. As the projects continued, clients' demands were constantly changing and the list of options in the RFPs were incrementally increased. At the same time, a rapid market entry was of the utmost significance to the client companies in order to capture market share and secure business profits. However, these firms were constrained by catalytic conditions (see Table 7), underscoring the need for FPC to maintain flexibility and keep up with the constantly changing demands of its clients as well as to meet budget and project deadlines, which were largely outside its control.

When client companies and the IT developers of FPC faced time pressures, they tended to prioritize developmental feasibility over the companies' ideal requirements, especially when close to project deadlines. FPC sought to rescope the remaining tasks to only include high valued options that could be completed by each deadline. I call this stage **Design Economization**, which refers to compromising on the original design of the system and "cutting corners" in systems development. In the short-term, this stage enabled client companies and the IT developers of FPC to take shortcuts to deliver incomplete RFP options by a client company's deadline. However, this made future maintenance more costly and difficult, for instance, by overlooking best system design practices, conducting inadequate testing, or hiding code complexity to meet the deadline. This subsequently introduced new digital debt related to additional maintenance and modification work. This parallels the argument of Malaurent and Karanasios (2020), who argued that in the context of enterprise

systems, workarounds, also known as adaptations and improvisations, are facilitated when a process is too cumbersome, information is incomplete, or situational constraints hamper work activities. An Associate of the R&D Department [A3] explained:

> *If the plans on RFP could not be fully completed due to inevitable limitations, the unstable system operation may arise as the future problem. In order to resolve this problem, additional manpower will be required, and this will bring monetary loss to companies.*

When a system is not being developed in line with the client companies' original requirements, Design Economization creates a form of digital debt related to deferred upgrading or maintenance work. I call this form of digital of debt **Functionality Debt,** which I define as the upgrading efforts and costs that will have to be paid off in the future because of the current incomplete execution of the original system design. The informants defined the term 'debt' as 'borrowing' and 'missing some functionalities.' That is, Functionality Debt can generate 'interest' related to the debt (Guo et al. 2016), which includes the additional modification expenses and efforts required to align the missing features with the users' actual requirements (Guo and Seaman 2011). By releasing a system earlier than its competitors, a firm is seeking to generate market share (Lim et al. 2012). However, high debt can have negative impacts by decreasing the system's reliability (Ramasubbu and Kemerer 2016). Senior Manager C of the S&P Department [S3] explained:

> *When client companies have a tight business schedule (and budget), they implement certain features first without aligning them with the overall system design. This action generates future system maintenance tasks. These additional modification obligations extend workload.*

On the other hand, the accrued Functionality Debt does not always imply negative consequences, and instead, the perceived benefits of debt accrual surpass its perceived cost in the short term. For example, FPC's companies leveraged Functionality Debt strategically by postponing maintenance and modification work and delaying development expenses to accelerate the pace of system delivery (Ramasubbu and Kemerer 2014), meet the original

project deadline, and preserve a limited budget. By releasing their systems earlier than their competitors, the companies can gain market share (Lim et al. 2012), generate sales revenue, and thus repay debt with the increased budget. These may be the reasons why firms constantly takes design shortcuts. This finding is in line with the study of Tom et al. (2013), who suggested that, on one hand, technical debt can be beneficial for system development by accelerating systems deployment and reducing the time to market. On the other hand, high technical debt can have negative impacts by decreasing the system's effectiveness and reliability.

3.4.4 Stage 3: Piecemeal Development

FPC's client companies tended to face pressures to introduce novel functionalities that would make their services more attractive and accessible to their consumers. However, many were reluctant to experiment with new digital technologies that could potentially impose high risks. In particular, many client companies were attached to the traditional *waterfall approach*, which refers to using rigorous and extensive planning and processes to ensure development gradually matures toward perfection (Boehm 2002). This deeply entrenched mindset and resistance to change can slow down the acceptance and application of new technologies (Lucas Jr and Goh 2009). In addition, digital innovation can be constrained by path dependency, which refers to the constraint of present decisions by an established trajectory (Baker et al. 2011). Over the years, this situation can accumulate a considerable amount of new digital debt.

Nevertheless, continuous innovation is pivotal to achieving sustained business profitability (D'Aveni et al. 2010) and desired innovation outcomes should be designed based on the end user's demands (Srivastava and Shainesh 2015). To address this situation, **Piecemeal Development** tends to be the preferred approach to system development. It is a fragmented approach that is centered on the rapid delivery of workable system at the earliest possible juncture. More specifically, this involves designing a minimum viable product (MVP), which

refers to "a version of a new product, which allows a team to collect the maximum amount of validated learning about customers with the least effort" (Ries 2011). Among FPC's client companies' options for long-term system planning, only the minimum core features were deployed and released in the market to fit their cost performance. The objectives of creating MVP were to decompose consumer demands, test the new features in shorter release cycles and a faster feedback loop, and incrementally extend, improve, and deploy a system with the least amount of money in the short term (Anderson et al. 2017). At this stage, tensions of learning were expected to arise through destroying past practices (i.e., waterfall approach) to create new innovations (Smith and Lewis 2011). In addition, the focus on the fast delivery of the system induced companies to incur new digital debt that would make future changes more costly (Avgeriou et al. 2016; McConnell 2008). Senior Manager C of the S&P Department [S3] explained:

> *When client companies have a tight business schedule (and budget), they launch certain (e.g., minimum core) features first in the market without aligning these features with the overall system design. This action generates future system modification tasks. These future obligations extend workload.*

Other than deploying minimum core features, additional features for the long-term viability of the system were not realized due to limitations with resources and capabilities influenced by catalytic conditions (see Table 7). This represented a different form of digital debt, which I term **Developmental Debt** as it is related to dormant features that are useful and required but are not developed. This situation means that companies must acquire additional resources in order to develop and add the features to the system later (Brown et al. 2010). Prior to applying new technology in a business operation, certain criteria should be satisfied, such as identifying sufficient test cases, conducting a thorough inspection process, and standardizing a systematic assimilation process (Tiwana 2015). In particular, standardization is an important procedure to reduce the coordination costs, interdependencies among the participants of the value network (Tiwana 2015), and uncertainties about information processing. This is because once a process

is standardized, each participant anchors around the standards, so that every engagement becomes more predictable and easier to follow up (Wang 2021).

However, standardization is a very long and cumbersome process that requires a dedicated quality assurance team, high levels of work pressure, and a very large budget. In the case of FPC, most of the resource constrained client companies did not have quality assurance teams. In addition, the informants identified that companies which regarded the IT department as the cost center, as opposed to the profit center, were more likely to remain conservative toward new technology assimilation. Given the resource constrained client companies' cost reduction pressures, the entire system design could not be deployed at the same time, and a future-oriented investment in new technology application was often pushed back as a business priority. This finding complements the work of Ramasubbu and Kemerer (2014), who suggested that initial debt accrual may be driven by compulsions to deploy emerging technology features before reliable design standards have been developed. In addition, a fragmented system may degrade long-term business performance by focusing more on addressing imminent consumer needs and overlooking the system's structural complexity (Ramasubbu and Kemerer 2016).

The Managing Director [D1] explained:

> *New technology carries high risks. People often have a preconceived thought that new technologies are not verified enough and thus hesitate to apply new technology in business operation. Therefore, we develop minimum core features of their platforms, so that their investors will verify the system design and then invest in our clients' businesses…. The rest of the functionalities except MVP become new digital debt.*

On the other hand, keeping the planned features dormant could act as a deliberate choice to counter catalytic conditions for a number of reasons. First, Developmental Debt accrual could reduce trials and errors, maximize learning and feedback, and conserve resources. Second, Developmental Debt accumulation could be leveraged to effectively present the feasibility of the new digital technology to investors and thus acquire investments for future business improvement. According to many of informants, there were many cases in which FPC and/or

client companies' decision makers refused to accept a system design after a project was 80 to 90 percent completed. Such cases incurred high cost and massive elapsed time, that sometimes resulted in abandoning the projects. Since, system development entails a long, complex, and cumbersome design process and requires significant amounts of organizational effort and cost, Developmental Debt could be strategically accrued to effectively deploy system features, conserve resources, and improve work flexibility by decoonstructing client demands and revising the design accordingly. This echoes the argument of Lim et al. (2012), who indicated that debt can benefit firms, at least in the short term, by enabling quick implementation of new features and by aiding the quick roll out of new features after initial adoption. However, in the long run, the operation of a debt-laden system can contribute to performance degradation because developers may not pay adequate attention to the system's structural complexity by focusing more on addressing immediate business needs (Ramasubbu and Kemerer 2016).

3.4.5 Stage 4: Redundant Concurrency

Finally, as with most new system development efforts, FPC's client companies typically had to undertake a radical architectural transformation, also known as componentization, which refers to moving from a largely unstructured legacy system (Seacord et al. 2003) to modern, component-based, modular systems architecture (Yoo et al. 2010a; Yoo et al. 2010b). An architectural transformation is a large, multiyear project and is critical to day-to-day operations (Seacord et al. 2003). It is an extensive and cumbersome process because it involves code migration, database migration, and a deployment approach, which entail high costs and intense work pressures, as well as shifts in organizational culture (Lucas Jr and Goh 2009) and firm identity (Tripsas 2009).

At this critical juncture, FPC's clients were still influenced by catalytic conditions (see Table 7). Their dependencies on the legacy system indicated complexity in transition. More

importantly, it was usually impossible to switch all consumers from the old to the new system at the same time. Hence, they tended to adopt **Redundant Concurrency**, which refers to the simultaneous operation and maintenance of both the legacy and new systems. The dual operation requires additional workforce and creates information inconsistencies across the systems. In particular, architectural transformation may fail when a firm has inadequate understanding of new system requirements, lack of planning, and situational constraints or anomalies (Gholami et al. 2017). An Associate of the Business Administration (BA) Department [A2] explained:

> *When existing consumers refuse to transition to a modern system, companies are forced to maintain the legacy system. Although the transition from the legacy to the next generation system is difficult, companies never give up the next generation system.*

Subsequently, Redundant Concurrency created a considerable amount of **Technical Debt** (Tom et al. 2013) amongst FPC's client companies, along with major associated maintenance obligations. In order to resolve the acquired technical debt, the companies had to modernize their system architecture periodically within a range that did not affect system reliability. However, their resource constraints tended to inhibit phasing in modules for architectural transformation. The *phased-in approach* refers to phasing in modules and functionalities implementation a few at a time (Mabert et al. 2003). The Managing Director [D1] explained:

> *The legacy system remains at the back-end, which needs to be changed a lot. This becomes giant technical debt. Architectural transformation requires significant expenses and time. Although companies expect the accrued technical debt, they do not fundamentally resolve it, but are forced to bear it.*

Alternatively, FPC assisted its client companies to enact Big-Bang architectural transformation every 10 years switching from a hierarchical structure (Baldwin and Clark 1997) to a requisite layered-modular architecture (Yoo et al. 2010a). The *Big-Bang approach* refers to implementing the entire system at a single point in time (Mabert et al. 2003). In either case, the shift from legacy to the modern system architecture cost tremendous time, money, and organizational efforts.

3.4.6 The Formation of a Vicious Cycle

When a new system is implemented against the backdrop of existing operations, it can lead to work overload (Gregory et al. 2015). FPC's client companies had to make decisions between outsourcing the modernization project, dedicating more IT developers to the project, or allocating longer work hours to the existing developers to complete the backlogs by the business deadlines. The consequence of a company outsourcing its system development was that it did not acquire the relevant development capabilities and knowledge. As a result, the accrued technical debt led to the accumulation of more Capability Debt by triggering a further iteration of Coerced Outsourcing. An Associate of the BA Department [A2] explained:

> *Dual systems management for the same platform is a burden as it requires extra human resources and expenses. The differences in the configuration of the legacy and the next generation systems require additional learning that can act as work stress.*

Overall, the four dimensions of digital debt – Capability Debt, Functionality Debt, Developmental Debt, Technical Debt – grow over time to form a **vicious cycle** of digital debt accrual that exacerbates the impacts of digital debt on companies. During Redundant Concurrency, the accrued technical debt was a serious issue for FPC's client companies and subsequently led back to Coerced Outsourcing. Because the companies needed to develop a new system for business survival, many of them were again forced to outsource their projects and accrued additional Capability Debt. This demonstrates that the evolving structural complexity of a system can make it challenging to eradicate existing digital debt (Ramasubbu et al. 2011). While FPC's client companies improvised multiple ways of developing new systems, they acquired different forms of digital debt. These companies were constantly challenged by, but had to withstand, the four dimensions of digital debt that stemmed from both the legacy system and the way in which the next generation system was designed, developed, and managed. This parallels the work of Banker et al. (2020), who found that the costs of technical debt increase in parallel with the evolution of a technical debt-laden system,

creating stronger negative impact over time.

3.5 Discussion and Conclusion

By integrating the findings across the four stages, a theoretical framework of digital debt accrual can be inductively derived to address the research questions set forth at the beginning of this paper (refer to Figure 2). This study suggests that digital debt is comprised of four dimensions: Capability Debt, Functionality Debt, Developmental Debt, and Technical Debt. Moreover, the findings of this study reveal that the process of digital debt accrual consists of four stages: Coerced Outsourcing, Design Economization, Piecemeal Development, and Redundant Concurrency. The framework focuses on how each stage contributes towards accruing different forms of digital debt. In particular, outsourcing is often coerced by the triggers for new system development, whereas the four stages of digital debt accrual are influenced by catalytic conditions.
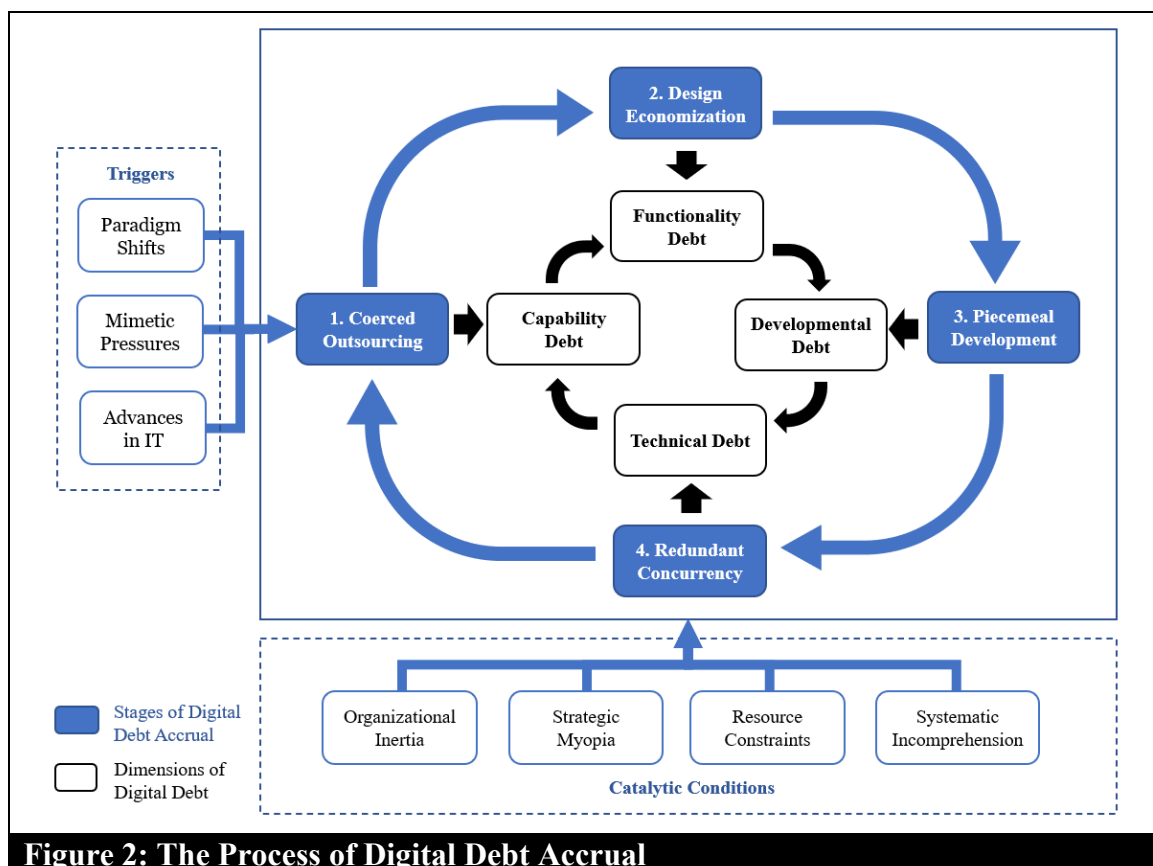
Figure 2: The Process of Digital Debt Accrual

More specifically, the triggers precipitate a client company into Coerced Outsourcing for new system development. When Paradigms Shifts happen (Tapscott and Caston 1993), the incumbent players may be coerced into developing a next generation system for customer acquirement, conversion, and retention purposes. The resource constrained firms tend to experience Mimetic Pressures (DiMaggio and Powell 1983) because the delay in market entry may result in significant loss of market share. At the same time, Advances in IT catalyze business process redesign (Kahre et al. 2017) to counter the problems of poor work efficiency, an information-intensive work process, and increased consumer complaints.

Moreover, catalytic conditions influence the entire process. Organizational Inertia may lead to slowing down the acceptance and application of new technologies (Lucas Jr and Goh 2009) because a deeply entrenched mindset can act as a barrier to innovation (Srivastava and Shainesh 2015). Being in a resource constrained state often results in a client company developing Strategic Myopia (Park et al. 2020), which increases the risks of being a market laggard as the company's management tends to focus on short-term business profits and less investment in innovation. Moreover, Resource Constraints impede the allocation of adequate budget and human resources for projects (Woodard et al. 2013). This often results in a company making ad-hoc development decisions. Lastly, Systematic Incomprehension may create misalignment between business and IT objectives (Tiwana and McLean 2005). The quality of CEO and CTO communication is, therefore, crucial to setting long-term visionary leadership, spurring business evolvability (Chan et al. 2019), and preventing a firm from accumulating catalytic conditions. The finding that triggers and catalytic conditions affect digital debt accrual echoes the work of Kruchten et al. (2012), who indicated that the causes of technical debt may include software aging, industry transformation, carelessness, lack of education, poor processes, resource constraints (Lim et al. 2012), and industry competition (Banker et al. 2020).

Driven by triggers, resource constrained client firms with lack of IT capabilities are often coerced into outsourcing (Loh and Venkatraman 1992) their systems development. Constrained by catalytic conditions, many client firms have poor IT performance, and some are without a dedicated IT department. In particular, their resource constraints often hinder the acquisition of the requisite digital skill set (Hess et al. 2016). As such, firms with poor financial and IT performance are more likely to outsource their IT work (Lacity et al. 2009). Coerced Outsourcing may create Capability Debt because project outsourcing can hinder firms from developing in-house digital capabilities. If client companies continuously resort to outsourcing, they may constantly suffer from a lack of capabilities.

Second, when a client company and the IT developers of FPC faced time pressures, they tended to conduct Design Economization, especially when it was close to the project deadline. In such situations, the original design of the system is compromised through workarounds, adaptations, and improvisations (Malaurent and Karanasios 2020). By rescoping the remaining tasks and prioritizing high valued options, Design Economization creates Functionality Debt due to sub-optimal system development. While cutting corners in system development may accelerate the speed of system delivery (Ramasubbu and Kemerer 2014), this can make future maintenance and modification more difficult and expensive (Guo et al. 2016). If this debt is not repaid promptly, the entailed interest related to the debt (Guo and Seaman 2011) will increase and the associated structural complexity may decrease system reliability (Ramasubbu and Kemerer 2016).

Third, FPC's client companies often felt pressured to introduce novel functionalities to make their services more attractive and accessible to their consumers (D'Aveni et al. 2010). However, attachment to traditional work processes (Boehm 2002), resistance to change, and path dependency can act as barriers to innovation (Baker et al. 2011; Lucas Jr and Goh 2009). As

such, Piecemeal Development tends to be the preferred approach to system development. However, other than the deployed minimum core features, additional features for the long-term viability of the system remain dormant, which generates Developmental Debt. Given the resource constrained client companies' cost reduction pressures, the entire system design cannot be deployed at the same time. As such, compulsive deployment of emerging technology features before developing reliable design standards may accrue debt (Ramasubbu and Kemerer 2014). In addition, a fragmented system may degrade long-term business performance by focusing more on addressing imminent consumer needs and overlooking the system's structural complexity (Ramasubbu and Kemerer 2016).

Fourth, as with most new system development efforts, FPC's client companies typically needed to undertake a system architectural transformation (Seacord et al. 2003; Yoo et al. 2010a; Yoo et al. 2010b). Given the transformation is often complex due to the considerable dependencies on the legacy system, these firms enact Redundant Concurrency, which creates technical debt (Tom et al. 2013). The acquired debt hinders system understanding and acts as a barrier to adopting best practices (Banker and Slaughter 2000). Since the resource constraints inhibit a phased-in approach (Mabert et al. 2003), companies adopt the Big-Bang approach (Mabert et al. 2003) to resolve technical debt. In any case, the shift from a hierarchical structure (Baldwin and Clark 1997) to a requisite layered-modular architecture (Yoo et al. 2010a) costs a great deal of time, money, and organizational efforts.

Finally, when a new system is implemented against the backdrop of existing operations, it can lead to work overload (Gregory et al. 2015). Likewise, when FPC's client companies were under schedule pressures and resource constraints, they tended to trade off in-house system development or architectural transformation for outsourcing. As a result, the accrued technical debt leads to the accumulation of more Capability Debt by triggering a further iteration of

Coerced Outsourcing. Overall, the four dimensions of digital debt – Capability Debt, Functionality Debt, Developmental Debt, and Technical Debt – will grow over time to form a vicious cycle of digital debt accrual that exacerbates the impacts of digital debt on companies. As long as digital debt is embedded in a system, the cost of debt is bound to increase over time along with system evolution (Banker et al. 2020).

3.5.1 Theoretical Implications

At the outset of the paper, I noted how there was a lack of research on the nature and the process of digital debt accrual. As one of the earliest studies to directly examine the nature and process of digital debt accrual, this study makes a number of theoretical contributions to theory development.

First, in relation to the first research question, this study supports the study of Rolland et al. (2018), who showed that digital debt is "the broader notion" that comprises both technical and informational debt (p. 434). The specific focus on the nature of digital debt has enabled us to extend the existing conceptualization of digital debt by revealing that it consists of four dimensions – Capability Debt, Functionality Debt, Developmental Debt, and Technical Debt – and these debts exist along a continuum. The theoretical model suggests that the different forms of digital debt play a particularly salient role in different stages of digital debt accrual.

The ideas introduced in this study are an important contribution because this study not only corroborates the findings of previous studies (e.g., Rolland et al. 2018; Tom et al. 2013; Woodard et al. 2013), but it also contributes to a more nuanced understanding of digital debt as a theoretical concept. According to my framework, technical debt may only manifest in the final stage of digital debt accrual. This suggests that the existing conceptualizations of digital debt in the literature may be centered on technical debt because this is the tangible outcome of the accrual process (see Rolland et al. 2018). However, prior to reaching this stage, the findings

suggest that there are different forms of debt that are accrued in three preceding stages, which all eventually contribute to technical debt. These preceding forms of debt should be subjected to more research in order to generate a more holistic understanding of digital debt accrual.

Moreover, although informational debt is not explicitly presented in the theoretical framework, it is implied across all forms of digital debt. First, informational debt can be associated with Capability Debt because a software vendor may not hand over its system development documentation to improve the IT capabilities of client companies. As such, the clients may not acquire new capabilities simply by outsourcing their projects. Second, Functionality Debt can be associated with informational debt because Design Economization facilitates workarounds, adaptations, and improvisations (Malaurent and Karanasios 2020) that may create incomplete documentation. Third, informational debt can be associated with Developmental Debt because Piecemeal Development may create structural complexity. For instance, when dormant features are later added to a system, documentation is constantly revised and supplemented, which may create information inconsistencies and hinder program comprehension (Banker and Slaughter 2000). Fourth, informational debt is accompanied by technical debt. Duplicate and inconsistent information can be inappropriately maintained across both legacy and modern systems (Rolland et al. 2018; Seaman and Guo 2011) due to Redundant Concurrency. This can manifest in ineffective work processes by constantly oscillating between the different systems.

Second, this study uncovers four different stages of digital debt accrual. My model illustrates how each stage introduces a new form of debt. This underscores that system development decisions made under catalytic conditions (Kruchten et al. 2012) can lead to the creation of more difficult and costly maintenance tasks (Guo et al. 2016). In addition, this study reveals how acquiring and failing to resolve debt associated with specific tasks can lead to additional design shortcuts associated with another debt. For example, in this study, failure to resolve

technical debt led to Coerced Outsourcing and exacerbated companies' Capability Debt. In doing so, the ideas introduced in this study are an important contribution because, at a more general level, accrued digital debt along with maintenance obligations hinder a system's modernization and evolvability (Brown et al. 2010).

More importantly, this study advances the idea that digital debt accrual is a cyclical process. In doing so, I extend previous studies on digital debt by presenting the **vicious cycle** of digital debt accrual. Most notably, Woodard et al. (2013) indicated that a firm may find itself in a "vicious cycle," oscillating between acquiring and reducing debt (p. 552). Similarly, Rolland et al. (2018) indicated that a firm may be constantly "challenged by digital debt" (p. 455). Both studies included this idea as the final remarks of their findings. Likewise, Ramasubbu and Kemerer (2016) hypothesized that a firm may "be in a continuous downward cycle" of accumulating technical debt, creating more structural complexity and making the firm more error prone and less reliable (p. 1491). While these authors hinted at the possibility of a vicious cycle, they did not actually explain how a vicious cycle comes about. This study takes a step further and shows how the vicious cycle of digital debt accrual is formed; that is, when a firm reaches the final stage of Redundant Concurrency and acquires technical debt, it may repeat the first stage of Coerced Outsourcing and exacerbate Capability Debt even further. The findings from this study show that the acquired digital debt may precipitate the accumulation of more debt and form a vicious cycle that exacerbates the impacts of digital debt companies.

Third, by examining triggers and catalytic conditions in the specific context of digital debt accrual, this study reveals the need for a more nuanced view of the antecedents of digital debt accrual. Prior studies have documented the causes of digital debt as factors that influence debt accumulation (e.g., Banker et al. 2020; Kruchten et al. 2012; Lim et al. 2012). However, this study's findings differentiate and describe triggers and catalytic conditions to advance the

notion of antecedents of digital debt. While prior studies may only provide insights on what factors to avoid in order to avoid digital debt (e.g., carelessness, lack of education, poor processes), the findings of this study enhance our understanding of the triggers that lead to system development, as well as our understanding of contextual catalytic conditions and their impact on the process of digital debt accrual.

Overall, I believe that the findings of this study show that digital debt comprises a broader scope than previously thought, and the process of digital debt accrual is a vicious cycle rather than a linear process. I also show that the antecedents of digital debt can be articulated further to explain a more specific role for each of the constituent elements. I therefore believe that I have been able to respond to Kruchten and colleagues' (2013, p. 51) call for researchers to expand the concept of digital debt and to better understand how to approach it "both from a theoretical and a practical perspective to advance its state of the art and practice."

3.5.2 Limitations and Future Research

This study is not without its limitations. First, although I uncovered the four stages of the process of digital debt accrual and the four dimensions of digital debt, we must acknowledge that other progression trajectories and variations in dimensions may be possible. Indeed, the theoretical framework suggests that digital debt accrual is influenced by certain triggers and catalytic conditions. As both triggers and catalytic conditions can take on a vast array of possible forms (e.g., Banker et al. 2020; Kruchten et al. 2012; Lim et al. 2012), we must acknowledge that the theoretical framework should not be taken to be exhaustive or universally invariable. It must be acknowledged that it is impossible to capture all possible variants of these factors within a single case study (Pan and Tan 2011) and those that have not been uncovered in this study would certainly be fruitful avenues for future research.

Second, although the single case research method adopted in this study is prevalently used in over half of all case research papers (Sarker et al. 2013) and is a "typical and legitimate endeavor" (Lee and Baskerville 2003, p. 231) in qualitative research, a general criticism of the method is the issue of generalizability or external validity (Walsham 2006). The constraining force of the generalizability of this study may lie in its singular context (Sarker et al. 2013). However, the findings of this study are nevertheless likely to be generalizable because this study invokes the principles of analytic generalization (see Silva and Hirschheim 2007) or what has been described as "generalizing from description to theory" (Lee and Baskerville 2003, p. 235). In any case, future research can be directed at statistically validating the propositions of my theoretical framework, so that the boundary conditions of this study can be better defined.

3.5.3 Implications for Practice

Beyond its theoretical contributions, I believe that this study also has important practical implications. More specifically, this study provides a number of indications on how practitioners can understand and mitigate the process of digital debt accrual, so that the potential digital debt accrual as well as the previously accumulated digital debt can be resolved to reduce the debt and increase the likelihood of software development success.

First, in articulating the stages of digital debt accrual and revealing the different dimensions of debt resulted from each stage, the findings of this study can be useful for resource constrained firms as they seek to better understand the precise mechanisms of digital debt accrual and how to use this understanding to identify ways in which to break the vicious cycle of digital debt accrual in software development settings. This study suggests that the type of debt a company acquires is shaped by which action it undertakes. In this regard, the framework presented in this study can be used as a diagnostic blueprint to assess which stages have been applied and which type of debts are embedded in systems. In particular, the model in this study reveals that

Redundant Concurrency facilitates the accumulation of technical debt and this may ultimately hinder developers' system comprehension and form barriers for adopting best practices (Banker and Slaughter 2000). A company enacting Redundant Concurrency may, therefore, adopt Big-Bang implementation (Mabert et al. 2003) to reduce the software migration time and accelerate the transition of end-users from the legacy system to the new system. Although costs and commitments for the Big Bang approach are still expected to be high, it may incur relatively lower cost, time, and efforts than the estimated 3 to 5-year phased-in approach (Brown and Vessey 2001). As such, appropriate implementation decisions can reduce technical debt and help the company break out from the debt cycle.

Second, practitioners can also benefit from an understanding of triggers and catalytic conditions. In this study, I contribute to this understanding by elaborating on the specific role of each element. This can provide prescriptions for minimizing the impacts of triggers and preventing the accumulation of catalytic conditions. In particular, this study suggests that one of the reasons why companies overlook investment in new technology may be due to Strategic Myopia (Weick 2012). Short-term focused management leadership may place a company at greater risk of being a market laggard. Without resolving Strategic Myopia, such companies may constantly suffer from the accrual of digital debt. Hence, long-term focused spending, such as upskilling existing IT developers to aid new technology assimilation, will develop the company's digital capabilities (Park et al. 2020). Understanding these dynamics would help practitioners to assess which conditions their companies have, and consequently, prevent them from accumulating catalytic conditions.

Third, in dividing digital debt into the specific categories, the theoretical framework suggests that a company can assess which digital debt it has acquired and pay attention to the specific form of debt. For example, if a company has only undertaken outsourcing (Loh and

Venkatraman 1992), the company can focus solely on resolving Capability Debt rather than all the debt categories. In other words, through a more specific assessment of a company's debt status (Woodard et al. 2013), companies may be able to effectively address their incorrect actions and resolve the debt that the companies correspond to and avoid over-reacting to the entire categories of debt. Overall, by providing insights into the nature and the process of digital debt accrual, it is hoped that this study can help practitioners and companies make the most of the efforts and resources invested in the management of digital debt and exploit their fullest potential.

CHAPTER 4: HIKIKOMORI AND TECHNOLOGY-ENABLED ESCAPISM: AN AFFORDANCES AND CONSTRAINTS PERSPECTIVE

4.1 Introduction

Hikikomori refers to a recognized mental disorder that manifests as "a state of social withdrawal for more than 6 months, not going to work or school except for occasionally going out, and not communicating with people besides family members" (Koyama et al. 2010, p. 70). The term is also used to describe individuals who are suffering from the disorder as well (i.e., individual afflicted with the disorder are called Hikikomoris). The disorder was first recognized in Japan, but has since transcended the boundaries of its originating culture to become an increasingly prevalent international condition (Kato et al. 2018). Today, there are many recent cases stemming from all over the world (Gent 2019) including countries such as USA, South Korea, India (Teo et al. 2015), Hong Kong (Wong et al. 2015), China (Wong et al. 2017), Brazil, Spain, Italy, and France (Kato et al. 2019). The afflicted are estimated at more than 2 million in Japan alone (Saito 2019), and they exhibit pathological behaviors such as barricading themselves in their rooms, withdrawing from contact with friends, parents and family members, not attending school or holding a job (Teo 2010) while spending more than 12 hours a day in front of a computer (Cerniglia et al. 2017). The broader consequences of the growing number of Hikikomoris include unemployment (Furlong 2008), increased suicide rates (Kato et al. 2019; Kato et al. 2012), as well as an overdependence on financial assistance from their parents and the social welfare system (Kato et al. 2019).

Information Technology (IT) has been identified as one of the key catalysts of Hikikomori development (Adamski 2018; Stip et al. 2016). And yet, despite the widespread acknowledgement of the influence of IT, there remains a lack of knowledge on the exact nature of this influence (Tateno et al. 2019). As will be elaborated on in the subsequent literature

review section, this lack of knowledge stems from at least two gaps in the existing literature. First, there is a general paucity of research on the role of IT in the context of Hikikomori development. For instance, according to Adamski (2018) and Stip et al. (2016), the prolonged daily use of Internet and the growing dependence on IT have an overarching influence on Hikikomori development, but there have been no explicit studies of how IT actually induces Hikikomori development in the literature to date. Second, of the handful of studies that have touched on the influence of IT, most of them have treated IT as a "black box". In other words, the implicit assumption is that once an individual has access to IT, the individual is automatically more likely to become a Hikikomori. However, this assumption should be examined more closely because even if different individuals have approximately the same access to IT, not all of them will acquire the disorder eventually. As such, an in-depth investigation of the precise mechanisms through which IT drives the development of this disorder is called for because it can shed light on how IT promotes the pathological behaviors associated with Hikikomori. This may prove to be a crucial first step toward treating the disorder (Tateno et al. 2019) and alleviating its significant economic and societal impacts (see Furlong 2008; Kato et al. 2019).

To address these research gaps, the objective of this paper is to examine how IT contributes to Hikikomori development from an affordances and constraints perspective. IT affordances refer to "action possibilities and opportunities that emerge from actors engaging with a focal technology" (Faraj and Azad 2012, p. 238). IT constraints, on the other hand, refer to potential limitations that holds an individual back from performing a particular action by using IT (Majchrzak and Markus 2012). This theoretical perspective may be especially appropriate for addressing the aforementioned gaps because it is centered on the possibilities and limitations that IT presents in terms of facilitating or inducing pathological behaviors. More specifically, I will conduct a study based on empirical evidence obtained from the case of the Yokayoka

Hikikomori Support Center (YHSC), one of the most successful centers in Japan based in the city of Fukuoka with a proven track record of treating Hikikomori through a variety of different treatment alternatives, both online and offline. In doing so, the aim of this study is twofold. First, I will develop and present a theoretical framework that illustrates the mechanisms of Hikikomori development that are associated with, or exacerbated by, IT. Second, beyond its academic implications, this study also aims to provide indications to practice on the role of IT on Hikikomori development, which can hint at the appropriate interventions for treating the disorder, and/or developing policies and guidelines for minimizing its economic and societal impact. Accordingly, the research question is: "How does IT contribute to Hikikomori development?".

4.2 Literature Review

4.2.1 Existing Research on Hikikomori

Introduced in the late 1990s, the term Hikikomori emerged in the psychiatry literature to describe young adults who avoid socialization by staying in their bedrooms over an extended period (Saito 1998). Hikikomori is a mental disorder associated with social isolation (Kato et al. 2019), social withdrawal (Kobayashi et al. 2003), school refusal syndrome (Uchida 2010), and solitude (Teo et al. 2014). The defining traits of a Hikikomori include (1) spending most of the day, and nearly every day, confined to one's home, (2) persistently avoiding social situations, (3) persistently avoiding social relationships, (4) having distress or impairment in one's daily routine or interpersonal functioning, (5) lasting at least 6 months, and which (6) cannot being explained by other mental disorders (Teo and Gaw 2010). In particular, individuals who leave their home for only 2-3 days per week, 1 day per week, or even less frequently (and possibly not even leaving their bedrooms at all) may be categorized as mild, moderate, or severe Hikikomori respectively (Kato et al. 2019). Individuals who are socially

withdrawn, but not for a duration of more than 3 continuous months may be noted as Pre-Hikikomori (Kato et al. 2019). Hikikomori "most often keep contact with the outside world using technologies (p. 58). Those afflicted display a lack of interest in establishing physical relationships with other people, do not participate in social life, and the Internet is often used as an "escape" from depression and everyday life" (Adamski 2018, p. 60). Hence, Hikikomori represents one of the most extreme manifestations of IT use (Adamski 2018; Stip et al. 2016).

The existing literature on Hikikomori can be classified into three main research streams (refer to Table 8). First, there are studies that have focused on the **antecedents** of Hikikomori. Studies within this research stream are aiming to identify the factors that induce Hikikomori development. For example, some of the most frequently identified factors include disrupted family dynamics such as dysfunctional parent-child relationships, parental separation, an over-protective approach to parenting also known as *amae* (Kobayashi et al. 2003), a traumatic childhood experience such as peer rejection and bullying (Teo 2010), and a resistance to social conformity (Uchida and Norasakkunkit 2015). While there is currently little research that examines the influence of IT, the handful of studies that touch on the topic assert that Hikikomoris tend to use the Internet profusely, and IT is one of the key catalysts of Hikikomori development (e.g., see Adamski 2018; Stip et al. 2016).

A second research stream is centered on the **consequences** of Hikikomori. Studies within this research stream are typically seeking to explain the adverse effects of the disorder. For instance, starting with school truancy and refusal as the initial manifestation of the resistance to social conformity and social withdrawal, Hikikomoris often display an unwillingness to go to work, unmotivated performance at school and work, and/or an extended period of unemployment (Furlong 2008). Hikikomoris are also accompanied by social impairment and distress, as well as social anxiety and fear that result in having few or no friends (Koyama et al. 2010) and an

Table 8: Selected Studies on Hikikomori	
Source	**Key Arguments/ Findings**
Antecedents of Hikikomori	
Kobayashi et al. (2003)	Disrupted family dynamics such as dysfunctional parent-child relationships or parental separation, and *amae*, also known as over-protective parenting styles, are the important contributors to the emergence of Hikikomori phenomenon.
Teo (2010)	Hikikomori is commonly attributed to a traumatic or an aversive childhood experience such as difficulty in school. The prominent problems include bullying, being shunned by social circles, taunting, and physical abuse by school peers.
Uchida and Norasakkunkit (2015)	The resistance to conform to social pressures and the cultural standard may contribute to becoming Hikikomori. The highly pressured and rigidly organized education and career expectations form regimented environments which often do not concede to non-conformist behavior.
Adamski (2018)	The dependence on IT and the Internet causes social withdrawal, which has become a global phenomenon. Influenced by the online communication tools, there has been a migration of social behavior from the real world to the virtual world.
Consequences of Hikikomori	
Furlong (2008)	School truancy and refusal are the first manifestation of the resistance to social conformity, withdrawal behavior and the precursor to full-blown Hikikomori. Irregular employment opportunities and the unemployed state can both be a contributor and a consequence. Hikikomoris often display unmotivated performance at school.
Koyama et al. (2010)	Hikikomori is accompanied by social impairment and distress. They are unmotivated to attend school or go to work even if they have duties. Severe social withdrawal is associated with social phobia, anxiety and fear.
Kato et al. (2019)	The desire to escape from the real world works similarly to both Hikikomori and suicide. The conditions of Hikikomori can be the risk factor of suicide.
Frankova (2019)	Hikikomori are characterized as having insufficient ability to identify and express their emotions and a tendency to self-aggressive behavior. They resort to verbal and physical hostility, as a protective behavioral reaction to their immediate environment and toward their parents.
Treatment of Hikikomori	
Kondo et al. (2013); Nagata et al. (2013)	Hikikomoris are treated with psychoeducation, aiming to restructure their thought regarding hypersensitivity towards peer relationships. They participate in group activities that are designed to accumulate experience on peer relationships under the supervision of counsellors.
Kondo et al. (2013)	Intervening in dysfunctional family relationships and family problems may be considered important for Hikikomori treatment because the family's resistance to promoting change due to fear of violence and aggravation of conditions has been commonly identified as an obstructive factor.
Kato et al. (2017)	Pokémon GO, a location-based augmented reality game that connects Internet society with real roadmaps, was suggested as a treatment approach. However, most people were independently staring at their own individual screens in parks and did not chat with strangers.
Wong et al. (2019)	Available interventions in East Asia include home visits, family support groups, art therapy, telephone and direct counselling, and use of HQ-25 questionnaire as an evaluation and diagnostic assessment tool.

overdependence on parents (Kato et al. 2019). Hikikomori conditions can be a risk factor for

suicide because it entails a desire to escape from the physical world (Kato et al. 2019). They

may refuse to communicate in-person with family members, while sometimes spending more

than 12 hours a day in front of a computer as the Internet becomes their main channel of communication (Cerniglia et al. 2017).

A third research stream focuses on the **treatment** of Hikikomori. Studies aligned with this research stream are examining the interventions and therapies for treating the disorder. Available interventions that have been prescribed include family support groups, art therapy, telephone and direct counselling, and the use of 25-item Hikikomori Questionnaire as an evaluation and diagnostic assessment tool (Wong et al. 2019). In addition, Pokémon GO, a location-based augmented reality game for the mobile phone has been suggested as a treatment approach, but it was found to be ineffective as most Hikikomoris ended up staring at their own individual screens and did not socialize with others even if they are physically co-located (Kato et al. 2017). Intervening in dysfunctional family relationships may also be an effective treatment as some Hikikomori families tend to refuse proactive treatment due to a fear of aggravating family conditions and violence (Kondo et al. 2013). In addition, psychoeducation is deemed an important treatment option as it helps Hikikomoris to become less hypersensitive toward social relationships. They can participate in group activities under the direction of counsellors and experience peer relationships (Nagata et al. 2013).

Based on the literature review, I was able to identify at least two research gaps in relation to the research question (i.e., How does IT contribute to Hikikomori development?). First, as indicated earlier, there are only a handful of studies that touch on the influence of IT, and even so these studies tend to be conceptual in nature and not corroborated by empirical evidence (Adamski 2018; Stip et al. 2016). These studies are also typically focused on investigating the correlation between the disorder and the overuse of IT (see Stavropoulos et al. 2019; Tateno et al. 2019). While IT has been recognized as a "double-edged sword" in that it has the potential to both facilitate (e.g., Adamski 2018; Stip et al. 2016) and treat Hikikomori (e.g., Wong et al.

2019), the role of IT in Hikikomori development has not been studied to a significant degree. This knowledge is important because IT can dramatically alter socialization patterns and promote social isolation because it can foster stay-at-home habits (Adamski 2018). As such, an understanding of how IT catalyzes Hikikomori development may be an important first step toward treating the disorder.

Second, of the handful of studies on the influence of IT, most of them have treated IT as a "black box". For example, Stavropoulos et al. (2019) stated that Hikikomori development is associated with the use of Internet (e.g., online games), and the condition is exacerbated for those who spend more time online. Similarly, Tateno et al. (2019) asserted that the overuse of the Internet induces users to withdraw themselves from physical social networks in order to engage in virtual interactions. As stated previously, the implicit assumption here seems to be that once a person has access to IT, the person would automatically be more likely to become a Hikikomori. However, it is surely the case that not all who have the same access to IT will inevitably and invariably become Hikikomori. In other words, there is a need to open the black box to gain an understanding of the precise mechanisms through which IT promotes Hikikomori development (Tateno et al. 2019) because this may pave the way for the development of targeted and effective interventions. As such, the objective of this study is to explore the mechanisms, intervening states and developmental pathways through which IT contributes to Hikikomori development.

Accordingly, I construct a theoretical lens by turning to studies on the IT affordances and constraints that are related to socialization. This is a particularly appropriate starting point for this study for the following reasons. First, an affordances and constraints lens can explain how technologies influence individual behaviors by providing a holistic perspective of what IT can do and limit (Faraj and Azad 2012). Second, IT can be applied for both "good" or "ill" purposes,

and the consequences of IT use can be negative for certain stakeholders, while being positive for others (Majchrzak et al. 2016). For example, Deng et al. (2016) reported that use of Amazon Mechanical Turk both empowers and exploits crowd workers. In a similar vein, Miranda et al. (2016) found that social media is both emancipatory and hegemonic in different stakeholders, while Leonardi (2007) suggested that a knowledge management technology both enhances training purposes and constrains computer technician's ability to learn from their co-workers. As such, the study of dual effects and diametrically opposed outcomes, such as intended (positive) and unintended (negative) consequences, as they occur simultaneously may deepen our understanding of the role of IT within the context in which it is applied (Majchrzak et al. 2016). Therefore, this body of knowledge is appropriate as a "sensitizing device" (Klein and Myers 1999, p. 75) to guide this study on the role of IT in Hikikomori development.

4.2.2 IT Affordances and Constraints Related to Socialization

The influence of IT pervades many social aspects of the lives of individuals. This implies that there are multiple IT affordances related to socialization that can manifest in different stakeholders (Leonardi 2011), and the actualization of these affordances stems from using and interacting with those IT artifacts (Markus and Silver 2008). Based on the definitions of IT affordances and constraints set forth at the beginning of the paper, the "potential uses" of IT (Markus and Silver 2008, p. 622) result "from the mental interpretation of things, based on our past knowledge and experience applied to our perception of the things about us" (Norman 1988, p. 219), and therefore, it is necessary to consider the interactions (Gibson 1986) between actors and the IT artifacts (Markus and Silver 2008).

One of the key IT affordances related to socialization is *Social Connectivity*, defined as what enables individuals to form social connections with one another (Ellison et al. 2007). This affordance enables individuals to build both bidirectional and unidirectional connections, that

these relationships can manifest in both the known and the unknown network. Another IT affordance is *Social Interactivity*, which refers to what enables interactions with others in virtual worlds, often using a virtual character (Wasko et al. 2011). These affordances are intertwined with *Control of Interactions*, defined as the ability to choose between varying forms of participation on online social groups, as a user can choose from a spectrum of forms ranging from passive lurking to proactive engagement (Green-Hamann et al. 2011). *Visibility*, which is another IT affordance related to socialization discussed in the literature, refers to the ability to manage one's social presence by making one's personal profile visible or invisible in the online space (Treem and Leonardi 2013). Going beyond text-based communication, interactive virtual worlds, where users can visualize themselves in the form of avatars and use gesture-based communication when interacting with others (Schultze and Orlikowski 2010), can increase *Social Presence*, which refers to the degree of salience and to which one perceives a sense of being in physical proximity with a "real" person (Kaplan and Haenlein 2010). This affordance can enhance intimacy and bonding between users. Overall, these affordances can all influence the breadth and depth of interpersonal relationships, and because of this, technologies have been increasingly designed to be adaptable and customizable to the needs of users (Leonardi 2011).

On the other hand, technology may constrain an individual's ability to undertake certain actions (Majchrzak and Markus 2012). To overcome these IT constraints, individuals could reject using IT or take steps to change their environment or routines (Leonardi 2011). In doing so, however, unintended and/or negative consequences may arise (Majchrzak et al. 2013). The IT constraints related to socialization that have been identified in the literature include the *Absence of Social Cues*, defined as the lack of understanding and responding to non-verbal expressions. People often use the contextual and social cues to reduce information asymmetry and uncertainty when engaging with a new counterpart (Overby et al. 2010). A second constraint

is *Weak-Tie Networking*, which refers to the loose connections between individuals because of easier and more convenient participation in virtual social groups. But on the other hand, there is the tendency of easily relinquishing one's virtual relationships when dissatisfied or disappointed with other individuals or the social group because of the weak ties (Ellison et al. 2007). Another constraint is *Interpersonal Trust Vulnerability*, which refers to the tendency for individuals to become more susceptible to trust violations in a virtual (weak-tie) network. Related to this constraint is the *Difficulty in Developing Long-Term Relationships* (Green-Hamann et al. 2011)*,* which refers to fact that virtual interactions promote information sharing but not emotional support, which may not develop into affectively intimate relationships (Wright and Bell 2003).

In summary, the IT affordances and constraints related to socialization may cause individuals to become increasingly dependent on IT when communicating with others and, consequently, trap them in a vicious cycle of social withdrawal. By using these previously identified affordances and constraints (summarized in Table 9) as a theoretical lens to analyze the case of YHSC, a theoretical framework that depicts the influence of IT on Hikikomori development is inductively derived to address the research question set forth at the beginning of the paper.

4.3 Research Methodology

The case research method was adopted for this study because it is especially useful for exploring emerging phenomena, examining processes (Rynes and Gephart 2004) and answering "*how*" research questions (Walsham 2006), all of which are conditions that are relevant to the research objectives of this study. In addition, as the IT affordances and constraints associated with Hikikomori development would consist of a technological and a social dimension, the multi-dimensional complexity of the phenomenon may make an objective approach to a research unfeasible (Wagner et al. 2010; Xue et al. 2005). Consequently, it may

be more viable to examine the phenomenon by considering the shared understanding, beliefs and norms among the relevant stakeholders instead (Klein and Myers 1999).

Table 9: IT Affordances and Constraints Related to Socialization	
Affordances	**Description**
Social Connectivity	The connectivity bridges between individuals, reinforces existing relationships, and provides a greater sense of community. Both the bidirectional and unidirectional connections are facilitated, which the relationships of connections can be manifested in both the known and the unknown network (Ellison et al. 2007).
Social Interactivity	When interacting with other avatars in virtual worlds users replicate experiences from the real world into the virtual world with the technical freedom to transcend the constraints and norms of real life (Wasko et al. 2011).
Visibility	Users can manage their social presence and be functionally visible or invisible to others by locating their personal information based on their personal needs (Treem and Leonardi 2013).
Control of Interaction	Individuals can choose to passively access to information and social support, give advice without relational commitment, begin and end social group access discretely without notice or consent of others (Green-Hamann et al. 2011).
Social Presence	Graphical 3D space and embodiment offer a visual environment that creates perspective, placement and practices of a virtual body into virtual interactions. The virtual presence in a shared space affords shared experiences, and a sense of being in physical proximity and being with others (Schultze and Orlikowski 2010). In virtual worlds such as Second Life, users can present themselves in the form of avatars and use a gesture-based communication (Kaplan and Haenlein 2010).
Constraints	**Description**
Absence of Social Cues	Virtual environments have an absence of contextual and social cues that are used to decrease information asymmetry and uncertainty issues. This increases the risk of engaging with an unreliable counterparty (Overby et al. 2010).
Weak-Tie Networking	A virtual world has an absence of physicality. This leads to the development of a weak-tie network, that entails risks of easily losing relationships when dissatisfied or disappointed (Ellison et al. 2007).
Interpersonal Trust Vulnerability	A weak-tie network leads an individual to become vulnerable to interpersonal trust violations and suffer from a lack of relationship commitment. This results in difficulty in forming long-term relationships (Green-Hamann et al. 2011).
Difficulty in Developing Long-Term Relationships	A lack of non-verbal social cues and reduced social presence can create the potential for hostile messages and difficulties in contacting a specific person for additional information or emotional support, impairing one's ability to form long-term relationships (Wright and Bell 2003).

From the research question, the selection of the case was based on two criteria. First, the selected case should be an organization with a proven track record in treating Hikikomori patients. This is because such an organization would likely be able to shed light on a wide range of Hikikomori causes and symptoms, which would add breadth and variety to my theorizing. Second, the selected case should have extensive experience in using IT in the treatment of the Hikikomoris, as this suggests that the organization possesses an understanding of the IT affordances and constraints related to Hikikomori, and are able to manipulate them in order to improve, and not exacerbate, the disorder. The case of the YHSC in Fukuoka is particularly appropriate because it is not only the most well-known and successful Hikikomori treatment center in Japan (Gent 2019), but it uses a variety of programs that blends both offline and online interventions to treat Hikikomoris, making it a revelatory or an extreme case (see Gerring 2009) for the purpose of this study.

YHSC is a Hikikomori treatment center that provides psychological counselling, career training, a youth employment facility, and organizes social activities for recovering Hikikomoris. The term Yokayoka means "take it easy" in the local dialect (Gent 2019). It was founded when Hikikomori researchers in Fukuoka wanted to establish an international collaboration to develop more effective treatment programs for the disorder. Consequently, the Fukuoka city and Japanese National government established YHSC in 2011. Contact with the center is typically initiated by the parents of the Hikikomoris over the phone, and the center would then link both the Hikikomori and the parents with the relevant support groups it organizes accordingly. As an example, the career training program of YHSC consists of (1) finding simple jobs with work that Hikikomoris can do to help develop their confidence, (2) teaching them how to interact with other people, (3) equipping them with job skills and offering job-specific training, and (4) allocating Hikikomoris to simple but unpaid tasks to nurture a sense of self-efficacy over time.

4.3.1 Data Collection

The study was designed with two main phases: a preparatory phase and a fieldwork phase. The aim of the preparatory phase was to collect and analyze data from a variety of secondary sources in order to obtain an overall understanding of YHSC and its operations and treatment programs. On the other hand, the focus of the subsequent fieldwork phase was to gather primary data that are specific to the research question and explore in depth the process of how IT contributes to Hikikomori development (Pan and Tan 2011). Interviews constituted the primary source of data (Myers and Newman 2007) and a total of 19 unique informants were interviewed over two main rounds of data collection (refer to Appendix C.1). Using chain referral sampling with the help of a "gatekeeper" (Pan and Tan 2011, p. 165), we identified and interviewed clinical psychologists from YHSC, psychiatrists, and owners of online counselling companies that have collaboratively developed IT-based treatments for Hikikomori. In addition, we interviewed individuals who are currently diagnosed with, or have recovered from, the disorder at the premises of YHSC. These informants were selected on the basis that they were well-placed to answer the interview questions we formulated in an emergent manner across the various iterations of data collection and analysis (as will be described later), and could provide an adequate and first-hand account of the interactions between technology and Hikikomori development. The interviews were conducted with semi-structured interview guides (see Appendix C.2 for a sample) that were designed based on the theoretical lens (see Myers and Newman 2007). The guide contained a standard set of questions on the nature and process of Hikikomori development, the drivers of the disorder, as well as the influence of IT. There were also specific questions tailored for each informant based on their role in the interview guide (e.g., the Hikikomoris were asked questions on the forms of IT they use and the aspects of IT that they particularly enjoy). Each interview took an average of 60 minutes and was digitally recorded and transcribed for data analysis.

4.3.2 Data Analysis

Data analysis was conducted in concurrent with data collection to take advantage of the flexibility of the case research method (Strauss and Corbin 1998). To manage the voluminous amount of data collected, I first adopted the visual mapping and narrative strategies to organize data (see Langley 1999). The visual mapping strategy involved documenting the trajectory of Hikikomori development, as well as the influence of IT in a series of conceptual diagrams. The narrative strategy entailed developing a complementary textual description of the process. Beyond serving as summary devices, the visual maps and narrative were verified repeatedly with some of informants to validate our interpretation of the informants' accounts (Klein and Myers 1999).

As discussed earlier, a theoretical lens consisting of an initial set of aggregate dimensions and second-order themes (e.g., see Dacin et al. 2010b) was first derived from the literature on IT affordances and constraints to guide data collection (e.g., the categories of affordances and constraints were two initial aggregate dimensions, while each specific instance of an affordance/constraint was a second-order theme). The data collected was then coded (see example in Appendix C.3) using a mix of open, axial and selective coding (Strauss and Corbin 1998). More specifically, open coding was first used to assign conceptual labels to excerpts from the interview to form first-order concepts (e.g., a "preference for virtual relationships" in the words of informants). Axial coding was then used to categorize the first-order concepts into second-order themes (e.g., the preference for virtual relationships was classified as a form of "Relational Escape"), while selective coding was used to abstract the second-order themes into aggregate dimensions (e.g., Relational Escape is conceptualized as a form of "IT Escape"). When coding, whenever new concepts, themes or dimensions emerged that challenged the existing schema represented by the theoretical lens, the schema would be modified (i.e., concepts, themes or dimensions may be added, replaced or removed) and the process of coding

would be restarted (Dacin et al. 2010b). The process of iterating between data, analysis and theory development and juxtaposing with the existing literature continued until the state of theoretical saturation was reached (Glaser and Strauss 1967).

4.4 Findings

The findings from this study of YHSC suggest that IT influences Hikikomori development by presenting three forms of escapes as the disorder progresses along a continuum. These escapes are composite IT affordances that allow Hikikomoris to withdraw progressively to virtual worlds, which provide the means of avoiding seriousness, work and the everyday life issues of the real world (Schultze and Orlikowski 2010). The three **IT Escapes** include the (1) Relational, (2) Emotional, and (3) Spiritual Escapes and, as will be discussed in the subsections that follow, are important enablers of Hikikomori development, with each escape more influential at a different stage of the process. These stages include the Pre-Hikikomori, Nascent Hikikomori, and Pathological Hikikomori stages (see Kato et al. 2020). In addition, the findings reveal a number of **Antecedent Conditions** that represent the facilitating factors of the disorder along all its stages of progression. There are **Physical Social Outcomes** as a result of the IT Escape of each stage as well, which refer to the typically unintended and negative consequences of IT use (Majchrzak et al. 2016) for the physical social relationships of the Hikikomoris. I illustrate these concepts with evidence from this case study of YHSC in the following subsections before presenting a theoretical framework that elaborates on the influence of IT use on Hikikomori development.

4.4.1 Antecedent Conditions of Hikikomori Development

Our findings suggest that the process of Hikikomori development is influenced by a number of drivers, including (1) Internet access, (2) a traumatic childhood experience (e.g., peer rejection,

bullying), (3) disrupted family dynamics (e.g., parental separation, overdependence on parents) and (4) social conformity and collectivism.

First, with the advent of the Internet in modern society, the proliferation of the **Internet Access** has affected the behavioral characteristics of people. The means of communication and socialization have been fundamentally altered. For instance, texting and social media have made synchronous communication asynchronous, which reduced the need to spend time with families and friends in person (Turel and Serenko 2012). In addition, the ways in which people played and spent time for leisure were increasingly shifted from the outdoors to indoors. Children began to play with friends via online games, while people began to spend more time on media platforms (e.g., Youtube, Netflix). Clinical Psychologist B (C2) from YHSC described the nature of modern living and the growing preference for engaging in online communication and interactions: *"More and more people enjoy this lifestyle. ... They engage in online social interactions. They interact with others through the Internet and online games, whom they will never meet in real life"*. Psychiatrist B (P2) added that the younger generation tended to be "digital natives" who were born and brought up in the presence of digital technology, and made the connection between Hikikomori and a heavy dependence on IT: *"Modern depression, modern Hikikomori. The younger generation tends to be heavy technology dependent people."* This resonates with the arguments of Adamski (2018), who suggested that the growing dependence on IT and the Internet has influenced the migration of social behaviors from the real world to the virtual world.

A second driver of Hikikomori development is a **Traumatic (or Aversive) Childhood Experience**, which is defined as difficulties in childhood social circles (typically in schools) that are manifested as bullying, being shunned, taunting, or outright physical abuse by peers (Teo 2010). Many of informants indicated that bullying is a significant social problem and it

precipitates self-isolation. The Head of YHSC's Shinjuku Support Station (M3) explained: *"Social issues are the main causes of Hikikomori. For example, bullying in junior high school. (The Hikikomoris) would shut themselves in their houses"*. This is in line with the work of Saito (1998), who suggested that school truancy is typically the first indication of social withdrawal behavior, and a key precursor of the mental disorder.

A third driver of Hikikomori development is **Disrupted Family Dynamics**, defined as dysfunctionalities in family life that may include overprotective parenting styles and parental separation (Kobayashi et al. 2003). In particular, the psychological concept of "*Amae"*, defined as an overdependence on parents in Japanese society (Doi 1973), has been identified by numerous informants to be more common in Hikikomori families (Kobayashi et al. 2003). In other words, an overprotective parenting style that is relatively common in Japan may foster an overdependency of a child on his/her parents, especially the mother. Psychiatrist C (P3) from YHSC explained: *"The mother and child relationship is especially important. Hikikomoris typically show a high level of dependence on their mothers"*. Informants indicated that parenting styles and the way of educating their children can affect the development of a child's communication skills. In addition, unemployed Hikikomoris living alone or with a single parent are eligible to receive financial assistance from the government social welfare system (Kato et al. 2019). This may also enable Hikikomoris to remain unemployed and shut in, which may result in broader negative economic and social implications.

Finally, **Social Conformity and Collectivism** has also been identified by the informants to be a driver of Hikikomori development. Social pressures and standards refer to a self-reinforcing identity and a general compliance with social imperatives for the sake of interpersonal harmony, with an emphasis on the development and propagation of internalizing behaviors (Uchida and Norasakkunkit 2015). The Head of Shinjuku Support Station (M3) of YHSC explained:

"Hikikomoris have a fear of facing obstacles and challenges in response to their experience of failure in peer relationships. They are very sensitive toward interpersonal relationships and they have tendency to give up easily, which easily develops into an unwillingness to become a part of society (e.g., get an occupation or receive education). They show dysfunctional social skills at school and the workplace, and are often unmotivated to work hard." In line with the findings, Uchida and Norasakkunkit (2015) suggested that the regimented environment that characterizes Japanese culture, comprising rigid education and career expectations, often makes less concessions to non-conformist behaviors or outcomes, such as the failure to graduate from a university or work in white-collar jobs. Moreover, the development and propagation of internalizing behaviors is emphasized for the sake of interpersonal harmony. This value is upheld in Japan, and indeed many Confucianist societies (Kawachi and Berkman 2001). Externalizing behaviors, such as causing disturbances or behaving violently, tend to be in conflict with the beliefs and values of collectivist cultures. Conversely, internalizing behaviors where problematic energy is directed at oneself rather than others, is often performed as a coping strategy (Kawachi and Berkman 2001). As explained by Hikikomori B (H2), these behaviors can be triggered by family problems: *"I take on everything by myself. I tend to overthink matters even if it is not a big issue. Even though nothing happened, I think and worry about my family deeply. If they face problems, I think deeply about whether it is my fault, and if I have done something wrong to them."*

Overall, with the shift from direct to indirect communication, and from outdoor play to indoor play, modern living in the digital age has resulted in people staying longer and more often at home. Moreover, the findings reveal that the influence of these antecedent conditions is not restricted to the initial stage of Hikikomori development, but rather across all of its stages. The Head of the Shinjuku Support Station of YHSC (M3) explained: *"Becoming Hikikomori is caused by experiencing disheartening situations throughout their lives and having shattered*

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self-esteem. They tend to have experienced prolonged harassment in their social circles." In addition, Clinical Psychologist A (C1) highlighted the association between the use of IT and Hikikomori: *"Many Hikikomori use computers to manage their SNS (social network sites) and communicate with other people. They would also use computers to search and get information. The Internet is their main communication tool."* These findings corroborate the study of Kato et al. (2019), which demonstrated that the family, school and/or working environments, stressful life events, and the availability of IT can pave the way for the development of the disorder. The antecedent conditions of Hikikomori development that were found to be salient in this study are summarized in Figure 3.

Figure 3: Antecedent Conditions of Hikikomori Development
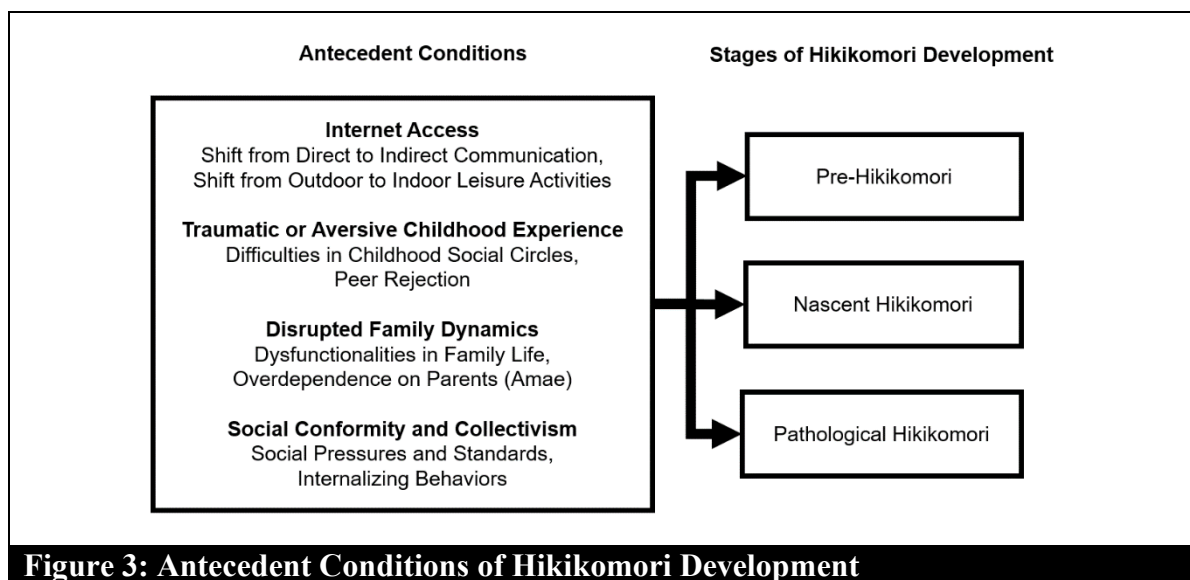
4.4.2 Stage 1: Pre-Hikikomori

Against the backdrop of these antecedent conditions, some individuals may be dissuaded from participating proactively in social activities to enter the **Pre-Hikikomori** stage. Prior studies have found that in this stage, individuals may still be attending school, going to work, or attending medical appointments, but they may limit the frequency of these face-to-face activities to a limited number of days per week (see Kato et al. 2019). Similarly, the informants indicated that limiting social activities and pursuing individual activities were the first

indications of Hikikomori development. The informants also labelled socially withdrawn youths, due to their heavy dependence on technology, as "Modern Hikikomoris" where the symptoms of the disorder are still mild and less apparent. Clinical Psychologist B (C2) at YHSC explained: *"They don't go out of their comfort zone. They go to work outside, but they are still trapped in their own bubble. This is a modern kind of Hikikomoris. This person has a job, but no social interaction with others. This person shows a bit of social withdrawal, so we consider them a bit Hikikomori. More and more people are turning to this lifestyle. This is a kind of social withdrawal, but these people will insist that they are not Hikikomoris."*

The **Relational Escape** was found to be of particular significance in the initial stage of Hikikomori development, which allowed individuals to withdraw from physical relationships and replace them with virtual relationships via media platforms. These platforms included social networking sites or virtual worlds that bundled the IT affordances of Social Connectivity (see Ellison et al. 2007) and Control of Interaction (see Green-Hamann et al. 2011) to provide a viable substitute for physical relationships (Gilbert et al. 2011). The data revealed that, on one hand, many individuals in the Pre-Hikikomori stage preferred individual activities such as surfing the Internet, binge-watching online video content and playing online games. Many of informants explained that these behaviors reflected the living habits of modern Hikikomoris where IT has become an essential part of their daily lives. On the other hand, the shift from direct to indirect communication has fostered a preference for online social connections. In particular, Hikikomoris tend to join and be proactively engaged in online communities (e.g., social networking sites) to interact with other users. In other words, this bundle of the IT affordances forms a relational escape that allowed users to form virtual relationships easily. Clinical Psychologist A (C1) at YHSC provided an illustration of the Relational Escape: *"Many Hikikomoris don't want to communicate with others in-person. Instead, they prefer to maintain online social connections. Many of them use the Internet to communicate with other people"*.

While these IT affordances supported the formation of virtual relationships, a **Lack of Corporeality** is an IT constraint that I found to be salient in the initial stage of Hikikomori development. I define this constraint as the absence of a direct physical presence, which can motivate individuals to take on more passive forms of socialization, such as lurking or information seeking (see Jiang et al. 2014), because they may be perceived to be more convenient, as well as less obtrusive or threatening (Porter et al. 2011). Consequently, the cost and effort invested by pre-hikikomoris in physical social activities may be reduced further as they substitute physical socialization with virtual socialization. Psychiatrist B (P2) explained: *"Technology enables Hikikomoris to connect with other people online, but they go into their rooms. They use the Internet to watch Youtube and play online games (for entertainment purposes). For these online activities, they don't have to make friends and don't need physical connections."*

This indicates that the Relational Escape, in tandem with the Lack of Corporeality, led to a gradual **Virtualization of Social Participation** as the primary physical social outcome of this stage. The virtualization of social participation is a state where individuals are migrating their social behavior online from the real world to the virtual world, and as they begin to form virtual relationships as an alternative to physical relationships (Gilbert et al. 2011), a decreased attentiveness to their physical relationships may also take hold. The Head of Hikari Lab and Sparx (M2) provided an example of individuals who withdraw from outdoor, physical social activities to participate more fully in indoor, virtual social activities in the form of online games: *"A Hikikomori is like a hardcore gamer. There is no difference. In both cases, they don't leave their home. In order to become a very good video gamer, a person needs to expend a lot of time and money on the game to develop his or her virtual fictional character."* As a consequence, there is a growing reliance on virtual connections as they can satisfy both the needs for entertainment and socialization. This finding echoes the work of Matook et al. (2015),

who suggested that loneliness is decreased when an individual builds reciprocal relationships with others via an online social network.

In summary, analysis revealed that the combination of Relational Escape, a composite IT affordance consisting of affordances of Social Connectivity and Control of Interaction, and the constraint of a Lack of Corporeality led to the gradual Virtualization of Social Participation in the Pre-Hikikomori stage (see Figure 4). And as the extent of withdrawal increases, Hikikomori development progresses from the Pre-Hikikomori to the Nascent Hikikomori stage.
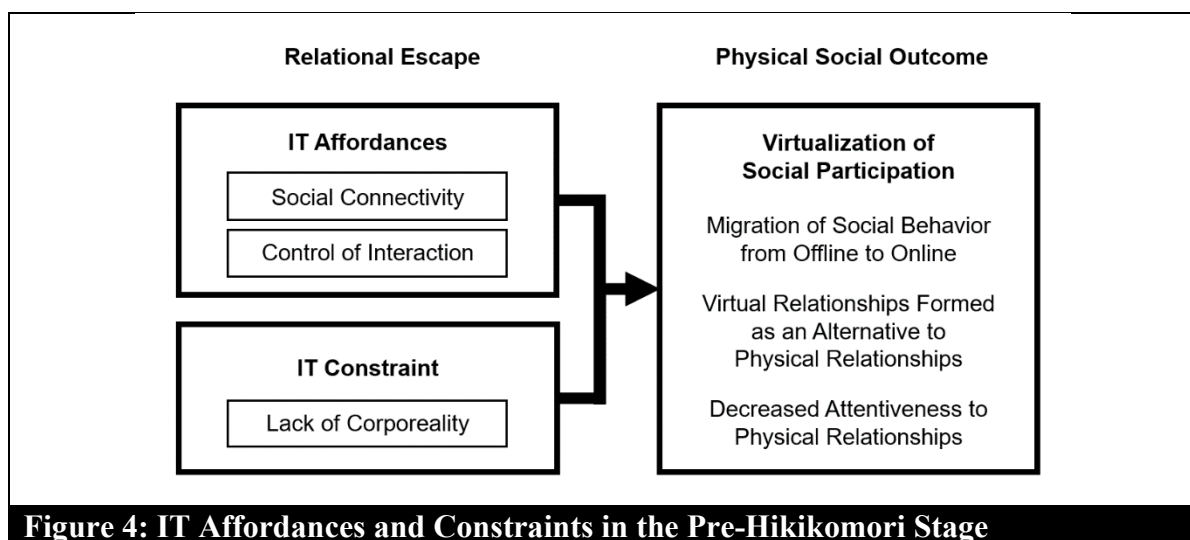
Figure 4: IT Affordances and Constraints in the Pre-Hikikomori Stage

4.4.3 Stage 2: Nascent Hikikomori

As the Virtualization of Social Participation becomes increasingly severe over an extended duration, an individual is officially classified as a Hikikomori (Kato et al. 2019). In this **Nascent Hikikomori** stage where the symptoms of the disorder are relatively milder (Kato et al. 2019), nascent Hikikomoris would rarely (e.g., 1 day per week or less) have meaningful physical communications and interactions with people outside home. They may also begin exhibiting a high rate of school truancy or absenteeism at work, potentially even getting expelled or losing their jobs (Kato et al. 2019). Their experience of facing challenges in the real world may have decreased their confidence in socializing with others. This is intertwined

with a tendency for internalizing behavior, which directs problematic energy at oneself rather than others as a coping strategy (Kawachi and Berkman 2001). More importantly, the Head of YHSC (M1) explained that Hikikomoris were financially supported by the social welfare system in Japan, a Psychiatrist B (P2) provided an illustration of the influence of *Amae* culture on Hikikomoris, where some individuals are willingly being labelled a Hikikomori so that they and their families can receive financial assistance from the social welfare system: *"Amae culture is common among Hikikomori families in Japan. A child over-depends on his or her parents, in most cases their mother, in terms of financial assistance. ... These people have deliberately chosen to be (labelled) Hikikomori. It is not just that people are suffering from the disorder, but some of them want to be called Hikikomori, so that they and their family can get paid by social welfare."*

In this stage, the findings of this study suggest that it was another composite IT affordance, which I term **Emotional Escape**, that played a more significant role. I define Emotional Escape as the IT-enabled means of forming affective connections between individuals in a virtual relationship. These relationships began to have a stronger influence on the individuals' emotions, which they are increasingly comfortable with expressing in the virtual space, as the virtual relationships grow to become more intimate than physical relationships. In particular, the findings of this study suggest that Emotional Escape stems from the integration of three affordances. First, there is the affordance of Social Interactivity as a result of participating on an online platform over a prolonged period, like when one become more and more engaged with an online community or game as he/she becomes increasingly comfortable and familiar with the virtual environment over time (see Wasko et al. 2011). A second affordance is what I term the Normalization of Failure, which is defined as the potential of IT to make failures more palatable or acceptable because their consequences tend to be less severe in a virtual space (e.g., the consequences of offending someone and "unfriending" another online is less severe than

doing so physically). Psychiatrist B (P2) provided an illustration using the example of online games: *"In online games, a user can die and respawn again and again. They don't feel the consequences of losing and dying in games as much. Technology limits the experience of failure for Hikikomoris. They become less aware of what are risky behaviors (over time)…"*

Moreover, many of informants indicated that Hikikomoris tend to be very active participants of 2Channel, the most popular discussion forum in Japan, primarily because they can maintain anonymity over extended interactions with others. This is a third affordance that forms part of the conceptualization of Emotional Escape, which I term Invisibility/Anonymity. Invisibility/Anonymity refers to the potential of IT in enabling an individual to decide if they wish to reveal their presence and identity to others, which can enhance the Hikikomoris' confidence in socialization (see Treem and Leonardi 2013). In addition, the informants described the dual effects of anonymity. While it reinforces confidence on one hand, Invisibility/Anonymity also allowed Hikikomoris to become online bullys and "trolls" because it eliminated the consequences of offensive or provocative behaviors. In other words, IT becomes an emotional outlet, which allowed the Hikikomoris to vent their frustrations in the form of externalizing behaviors, such as causing disturbances, enacting violence, and directing aggression at others as an alternate coping strategy (Kawachi and Berkman 2001). The Head of Hikari Lab and Sparx (M2) provided an illustration of the effects of Invisibility/Anonymity: *"Hikikomoris have very low levels of confidence. On Twitter and 2Channel, an individual is anonymous. This makes the person more confident (in interacting with others). But on the other hand, this can also turn a Hikikomori into a cyberbully in the online space, because it provides an outlet for their angry emotions… But when a Hikikomori is angry and negative frequently and persistently for a lengthy period of time in the online space, other online users may stop listening to and communicating with the Hikikomori"*. In other words, if cyberbullying behaviors persisted for an extended period, social rejection could occur as other online users

would gradually stop communicating and interacting with the Hikikomori. When this happens, Invisibility/Anonymity can also enable a Hikikomori to "lie low" for a while, and change/reinvent their online persona in response to social rejection (Mitrou et al. 2014).

While Emotional Escape facilitated the deepening of virtual relationships, the **Absence of Social Cues** (see Overby et al. 2010) was found to be a particularly important constraint in the Nascent Hikikomori stage. As Hikikomoris tend to have a Traumatic Childhood Experience characterized by peer rejection and bullying (i.e., one of the antecedent conditions of Hikikomori development discussed earlier), they can be highly vigilant and hyper-sensitive to the signals of social rejection (Teo et al. 2014). The Head of the Home E-Learning Department from Sarana E-learning (M4) explained: *"Hikikomori students choose to do home learning and they refuse to go back to school. One of our students' actual age was in high school level but he stopped attending school from 5th grade…. As they have not engaged with peers for long-term, they display highly sensitive behaviors towards what others say and the way others behave"*. However, because of the limited ability of IT to convey social cues (Tanis and Postmes 2003), my findings suggest that this constraint has the unintended positive effect of enabling Hikikomoris to remain a part of a virtual community because the negative social cues are not as easily detected or interpreted, as opposed to withdrawing themselves from the community the moment negative interactions or social experiences arise.

As a result of the Relational Escape and the Absence of Social Cues, many of informants indicated that they experienced a gradual **Withdrawal from Physical Relationships** as they started to rely more on their virtual relationships to fulfil their emotional needs. Clinical Psychologist A (C1) explained: *"Hikikomoris are very, very sensitive. They worry about how they are seen by others and they are afraid of social contact. They care about how others think about them too much"*. Consequently, the Hikikomoris in this stage begin to have fewer face-

to-face interactions with people outside of home (Matook et al. 2015), which subsequently leads to detachment and distancing in relation to physical relationships. These findings resonate with those of Tateno et al. (2019), which indicated that the overuse of the Internet induces users to isolate themselves and replace physical interactions with online interactions. But this study takes this a step further by revealing the dual effects of IT on Hikikomori development – while IT is *intentionally* designed to enrich virtual interactions, it *unintentionally* displaces physical interactions to exacerbate the progression of the disorder.

Overall, analysis revealed that the combination of Emotional Escape, a composite IT affordance consisting of affordances of Social Interactivity, Normalization of Failure, and Invisibility/Anonymity, as well as the IT constraint of Absence of Social Cues led to the gradual Withdrawal from Physical Relationships in the Nascent Hikikomori stage (see Figure 5).
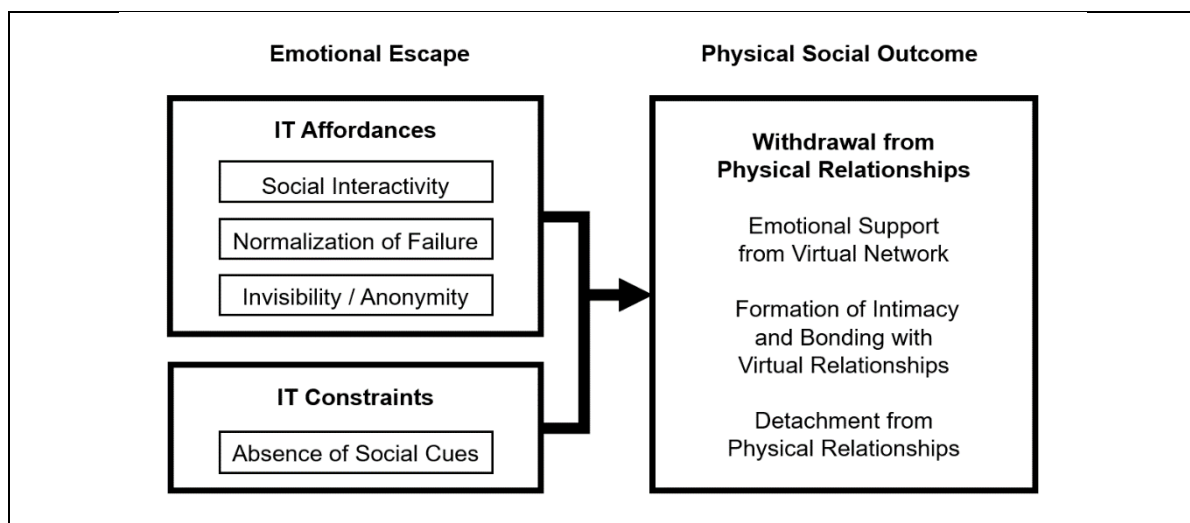
Figure 5: IT Affordances and Constraints in the Nascent Hikikomori Stage

4.4.4 Stage 3: Pathological Hikikomori

Finally, as the extent of Withdrawal from Physical Relationships grows over time, the disorder progresses into the **Pathological Hikikomori** stage. In this stage, the symptoms of the disorder are at their most severe with the manifestation of multiple extreme and problematic behaviors

(Kato et al. 2019). For example, Hikikomoris may choose to barricade themselves in their bedrooms, refusing to step out at all and withdrawing from all social contact with even their immediate family members and the people they live with (Teo 2010). More specifically, the pathological stage of the disorder entails an extreme avoidance of others due to social anxiety (Kato et al. 2019) and a crippling fear of social rejection, embarrassment and criticism (Teo and Gaw 2010). More specifically, adverse reactions to the Withdrawal from Physical Relationships of the previous stage can result in the development of a fear of embarrassment and criticism among the Hikikomoris. Clinical Psychologist A at YHSC (C1) explained: *"Many (advanced) Hikikomoris face great difficulties in communicating with other people. From the personality test perspective, we call it a developmental disorder or an autism spectrum disorder (that affects communication, social skills and behavior)"*.

In this stage, these findings suggest that it is the composite IT affordance I term **Spiritual Escape** that plays a defining role in catalyzing Hikikomori development. Spiritual Escape refers to the IT-enabled means of living a near total virtual existence, which is characterized by the complete immersion of an individual in a virtual environment such as those presented by online games and/or virtual reality simulators. This escape bundles the affordance of Social Presence (see Kaplan and Haenlein 2010) with an affordance I term Virtual Existence, which is defined as a digital life and a state of being within an online environment. In other words, the representation of a Hikikomori in the virtual world begins to take precedence over the individual's real world identity and the experiences of the simulated space takes primacy over physical reality (see Schultze and Orlikowski 2010). For instance, it is not uncommon for Hikikomoris to have a virtual girlfriend/boyfriend, or even marry a virtual "waifu/husbando" (i.e., a digitally animated wife or husband). A mother of a Hikikomori (PH1) illustrated how IT was used as a Spiritual Escape for her son: *"My son played online games all day for 10 years since he was 16 years old. By playing games, he wanted to forget everything and his*

school life. Playing game was very important to him so he was always playing games". The Owner of Favery Video Game Company (M5), a gaming firm that collaborates with YHSC in the development of digital Hikikomori treatment solutions, added: *"A user could build an attractive character on their own. Based on the characteristics of the virtual fictional character that the user made… users may build relationships with their character, or even fall in love with the character."*

As the Spiritual Escape has made what amounts to a virtual life possible, these findings reveal that the **Time and Cost Commitments** of an online existence becomes a crucial constraint in the Pathological Hikikomori stage. More specifically, with the time and costs invested in developing and living a virtual life, which can take up most of a Hikikomori's waking hours (Stip et al. 2016), the Hikikomori has little left for physical socialization, or they would deliberately choose to remove themselves entirely from the opportunities to interact with others physically (Gilbert et al. 2011). Psychiatrist A (P1) provided an illustration of this IT constraint: *"Hikikomori physically isolate themselves. They withdraw from going out and participating in social situations (e.g., go to work and school). They don't directly contact with friends and only limit social contact to the family members and the people they live with. They don't communicate or interact with others in a physical setting because they are so active online."* In addition, the Head of Hikari Lab and Sparx (M2) explained: *"In the 2Channel forum, there is a section called Hikikomori 10th anniversary. Hikikomoris make fun of themselves and celebrate it together."* This implies that Hikikomoris are not forcibly isolated by third parties, but they deliberately withdraw themselves (see Coplan and Bowker 2014) and this choice is something to be celebrated.

The outcome of combining the workings of a Spiritual Escape with the Time and Cost Commitments of a virtual existence is **Complete Physical Isolation** as the Hikikomoris turn

to online channels to fulfil their needs for socialization, companionship, and even love. The withdrawal from physical socialization in this stage is usually so severe that the Hikikomoris' physical relationships are near completely substituted by virtual relationships. As Complete Physical Isolation takes hold over a prolonged period, many Hikikomoris may even develop an irrational fear or aversion of social situations (see Kato et al. 2019). A Mother of a Hikikomori (PH1) described this condition: *"My son (a Hikikomori) could not go outside. He was afraid of going outside and encountering social situations"*. Psychiatrist B (P2) elaborated further on this acute form of social withdrawal: *"Hikikomoris prefer not to talk to their family members. This may lead to a bad relationship with the family members. But they still stay at home… Hikikomoris don't go out, don't have friends, and avoid social contact. In most cases, their family members worry about their situation, but Hikikomoris choose to remain alone in their rooms."* This finding extends the study conducted by Gilbert et al. (2011) in the context of Second Life, which suggested that virtual relationships can be perceived to be just as real and intimate as physical relationships by users. But as opposed to being long-distance relationships that are complementary to a user's physical relationships, virtual relationships become the dominant, if not the only, form of social relationships for the Hikikomoris.

To summarize, analysis revealed that the combination of Spiritual Escape, a composite IT affordance consisting of affordances of Social Presence and Virtual Existence, and the constraint of Time and Cost Commitments led to the Complete Physical Isolation in the Pathological Hikikomori stage (see Figure 6).
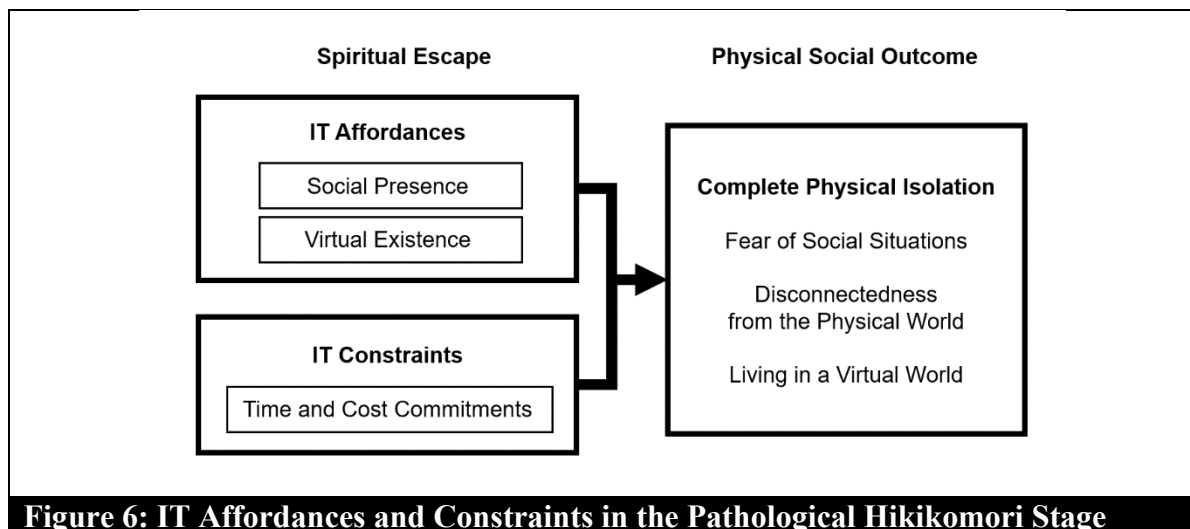
Figure 6: IT Affordances and Constraints in the Pathological Hikikomori Stage

4.5 Discussion and Conclusion

By integrating the findings across the three Hikikomori stages, a theoretical framework depicting the influence of IT on Hikikomori development can be inductively derived to address the research question set forth at the beginning of this paper (see Figure 7). In particular, this study suggests that there are **Antecedent Conditions** that have an influence on all the stages of Hikikomori development. More importantly, the findings reveal that IT influences Hikikomori development by presenting affordances that constitute three different forms of **IT Escapes**: the (1) Relational, (2) Emotional and (3) Spiritual Escapes. These escapes are important enablers and catalysts of Hikikomori development, and each is more influential at a different stage of the process as the disorder progresses along a continuum across the Pre-Hikikomori, Nascent Hikikomori and Pathological Hikikomori stages. In tandem with the effects of various **IT Constraints** (i.e., Lack of Corporeality, Absence of Social Cues, Time and Cost Commitments) in each stage, the IT escapes precipitate **Physical Social Outcomes** that encompass the unintended and negative consequences of IT use (Majchrzak et al. 2016) for the physical social relationships of the Hikikomoris. These outcomes include the Virtualization of Social Participation, Withdrawal from Physical Relationships and Complete Physical Isolation.
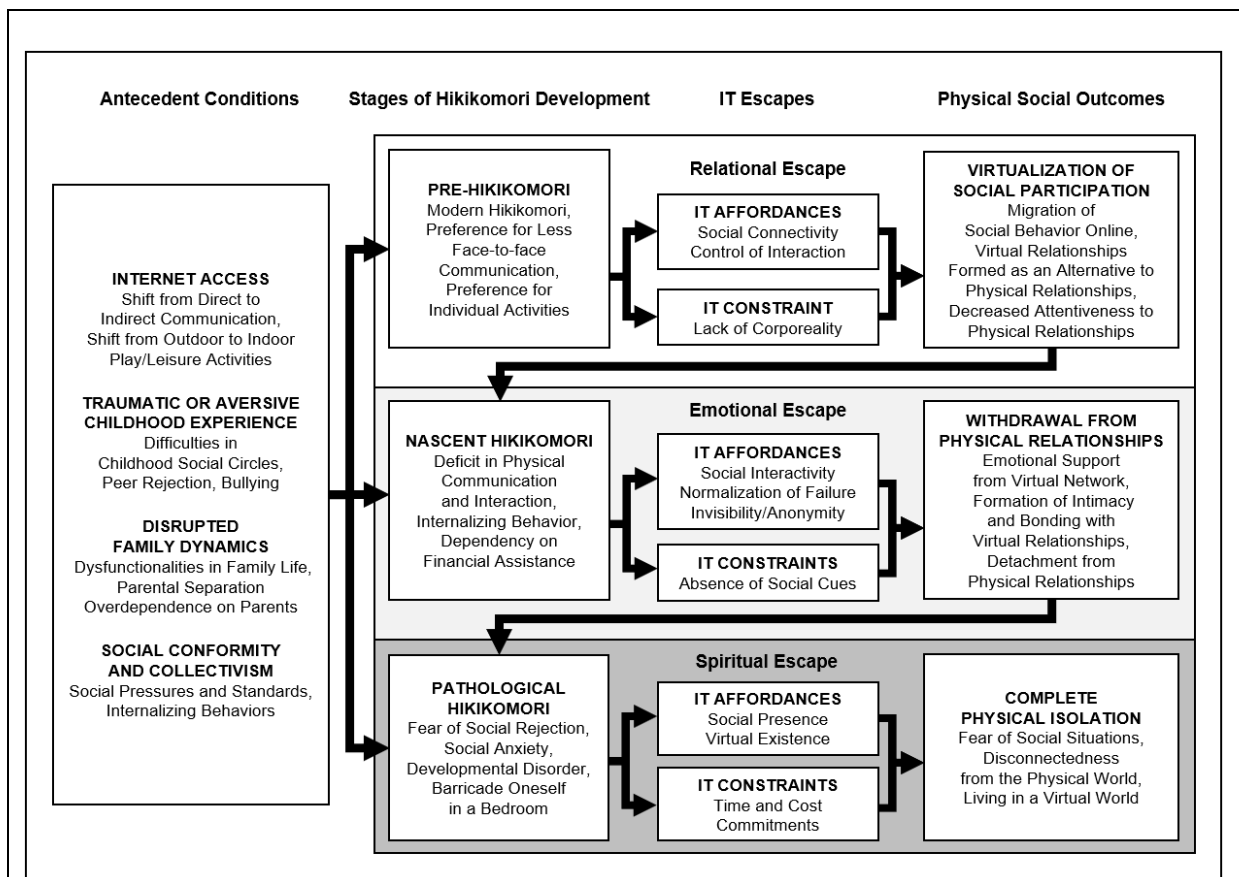
Figure 7: How IT Contributes to Hikikomori Development

More specifically, the **Antecedent Conditions** of Hikikomori development include (1) Internet access, (2) a traumatic childhood experience (e.g., peer rejection, bullying), (3) disrupted family dynamics (e.g., parental separation, dysfunctional parent-child relationships, overdependence on parents) and (4) social conformity and collectivism. The effect of these drivers on all stages of the disorder is both supported by the findings and corroborated by the existing literature (see Adamski 2018; Kondo et al. 2013; Teo 2010; Uchida and Norasakkunkit 2015). For instance, the antecedent conditions identified echoes the work of Kato et al. (2019), who found that the family, school and/or working environments, stressful life events, and the availability of IT can pave the way for the development of the disorder.

In addition, my theoretical framework suggests that the influence of IT on Hikikomori development is channeled through three forms of IT escapes, with each IT escape more

influential at across the various stages of Hikikomori development. In the **Pre-Hikikomori** stage, the **Relational Escape** is especially important as it allows individuals to form virtual relationships via media platforms. The Relational Escape is a composite IT affordance consisting of the affordances of Social Connectivity (see Ellison et al. 2007) and Control of Interaction (see Green-Hamann et al. 2011), and coupled with the constraint of a **Lack of Corporeality**, it allows for the formation of virtual relationships as an alternative to physical relationships (Gilbert et al. 2011). In other words, there is a gradual **Virtualization of Social Participation** as the primary physical social outcome, where pre-Hikikomoris begin to engage more and more in online interactions (Tateno et al. 2019) while possibly becoming less attentive to physical relationships.

As the Virtualization of Social Participation becomes increasingly severe over an extended duration, Hikikomori development progresses from the Pre-Hikikomori to the **Nascent Hikikomori** stage (Kato et al. 2019). At this stage where the symptoms of the disorder are relatively milder (Kato et al. 2019), Hikikomoris tend to eschew physical socialization outside of home and begin to internalize their negative emotions, directing them at oneself rather than others (Kawachi and Berkman 2001). Moreover, evidence from this case study indicates that the Amae culture and an overprotective approach to parenting could foster the Hikikomoris' overdependency on their parents. In this stage, these findings suggest that it is a different combination of IT affordances, which I term **Emotional Escape,** that plays a more significant role. This escape represents the IT-enabled means of forming affective connections between individuals in a virtual relationship via online platforms over a prolonged period, and bundles the affordances of Social Interactivity (see Wasko et al. 2011), Normalization of Failure (see Ravaja et al. 2008) and Invisibility/Anonymity (see Treem and Leonardi 2013). The latter, in particular, could allow the Hikikomori users to direct problematic energy at others (Kawachi and Berkman 2001) in their interactions with others online. But while causing disturbances and

being abusive or violent may result in social rejection, the former two affordances can reduce its impact for the Hikikomoris. In addition, the constraint of the **Absence of Social Cues** (see Overby et al. 2010) may cause Hikikomoris to be less able to detect and interpret negative social cues that stem from unpleasant interactions or social experiences. Consequently, this has the unintended positive effect of enhancing the staying power of the Hikikomoris in the context of their participation in a virtual community. The result of the actualization of both the Emotional Escape and the Absence of Social Cues is a gradual **Withdrawal from Physical Relationships** as they start to rely more on their virtual relationships to fulfil their emotional needs and have confidence in online social interaction. Importantly, this study reveals the dual effects of IT on Hikikomori development – while IT is *intentionally* designed to enrich virtual interactions, it can also *unintentionally* displace physical interactions to exacerbate the progression of the disorder.

Finally, the theoretical framework suggests that as the extent of Withdrawal from Physical Relationships grows over time, Hikikomori development progresses from the Nascent Hikikomori to the **Pathological Hikikomori** stage. In this stage, the symptoms of the disorder would be at their most severe with the manifestation of multiple extreme and problematic behaviors (see Kato et al. 2019), which include barricading themselves in their bedrooms (Teo 2010), and developing social anxiety (Kato et al. 2019) and a general fear of social situations (Teo and Gaw 2010). The findings suggest that it is the composite IT affordance which I term **Spiritual Escape** that plays a defining role in catalyzing Hikikomori development in this stage. This form of escape refers to the IT-enabled means of living a near total virtual existence, which is characterized by the complete immersion of an individual in a virtual world. The affordance of Social Presence (see Kaplan and Haenlein 2010), coupled with the affordance of Virtual Existence that begins to take precedence over a Hikikomori's physical identity (Schultze and Orlikowski 2010) makes it extremely difficult for Hikikomoris to break away

from their reclusive habits, behaviors and routines. Moreover, the constraint of **Time and Cost Commitments** associated with their virtual existence can mean that they are less able to dedicate attention to their physical existence. The result is **Complete Physical Isolation** as the Hikikomoris rely on virtual channels exclusively to fulfil their needs for socialization, companionship, and even love. A vicious cycle culminates in its apex at this stage as the Hikikomoris may refuse to step out from their bedrooms completely and withdraw from all social contact with even the people they live with and their immediate family members (Teo 2010). As such, virtual relationships become the predominant, if not the only, form of social relationships for the Hikikomoris (Gilbert et al. 2011).

4.5.1 Theoretical Implications for Hikikomori Development Research

At the outset of the paper, I noted how there was a lack of research on Hikikomori development from a technology affordances and constraints perspective even though IT is likely to have an important influence on the process (Adamski 2018; Stip et al. 2016). In being one of the earliest targeted at an in-depth exploration of the role of IT, this study has made a number of theoretical contributions.

First, the theoretical framework, developed based on the case of YHSC, presents a nomological network that illustrates how IT may contribute to Hikikomori development across three stages (i.e., Pre-Hikikomori, Nascent Hikikomori, Pathological Hikikomori), and reveals the impact of IT on the Hikikomoris' physical social life in each stage. More specifically, the framework provides an in-depth view of how IT can induce the (1) Virtualization of Social Participation, (2) Withdrawal from Physical Relationships, and (3) Complete Physical Isolation as the disorder becomes progressively severe. The theoretical model of this study is thus an important contribution as it presents a detailed and empirically grounded explanation for Hikikomori development from an uncommon IT-centric perspective. In doing so, the theoretical framework

can be used to explain how the use of IT can make a virtual existence an increasingly attractive and viable alternative, while at the same time limiting a Hikikomori's physical social actions and, in turn, reducing their attachment to the physical world.

Second, prior studies that have touched on the role of IT have essentially treated its influence as a black box (e.g., Tateno et al. 2019) without actually delving into the underlying mechanisms of this influence. By introducing the notion of IT Escapes, which are made up of a number of previously discussed (e.g., Social Interactivity and Control of Interactions) and newly conceptualized (e.g., Normalization of Failure, Virtual Existence) affordances, and revealing how they can interact with a number of IT Constraints to precipitate the physical social outcomes of each stage of the disorder, this study has provided a more nuanced and sophisticated view of the influence of IT. Moreover, in revealing how the influence of IT evolves with the progression of the disorder, future studies seeking to explore Hikikomori treatments and interventions can use this theoretical framework as a baseline theory to target the mechanisms that I have identified. In doing so, a more holistic and comprehensive understanding of the options we have for treating the disorder may emerge.

4.5.2 Theoretical Implications for IT Affordances and Constraints Research

This study also makes a number of contributions to the literature on technology affordances and constraints. First, this study introduces a number of conceptual innovations that extend the existing understanding of IT affordances and constraints (Majchrzak et al. 2016). For example, I have introduced the concept of an **IT Escape** and the three possible variants of this composite IT affordance. This study also hints at the notion of unintended affordances, where IT artifacts are used in ways that were not foreseen by their designers and developers when they were first conceived and created. The existing literature on affordances and constraints tends to assume that technologies are fixed and immutable, and consist of planned or designed affordances that

can easily be actualized or made to work (e.g., Majchrzak and Markus 2012). While the notion of unintended consequences have been acknowledged to be significant in previous works (e.g., see Majchrzak et al. 2013), there has been little research to date on how affordances may be unintended as well, as IT can be used in unexpected ways and result in different outcomes than what was originally intended. For example, the objective of developing an online game or a social networking site is surely not to turn people into Hikikomori. However, the fact is that these platforms may be serve as a form of escape for the Hikikomoris, which highlights the potential unintended affordances of these artifacts. This notion is thus an important contribution, as it suggests that we need a more dynamic and heterogenous view of what are affordances and how do they come to be. The notion of unintended affordances also extends our current conceptualization of the unintended consequences of using IT (see Majchrzak et al. 2016).

Second, by examining technology affordances and constraints in relation to socialization in the specific context of Hikikomori development, this study has contributed to a more holistic understanding of the affordances and constraints that are relevant to this setting. More specifically, this study has not only uncovered a number of new affordances and constraints that have not been previously identified in the literature (e.g., Normalization of Failure, Lack of Corporeality), but it has also revealed that some of the affordances and constraints that have been discussed may be more complex and multi-faceted than originally thought (e.g., Absence of Social Cues is typically viewed only as a constraint that detracts from the richness of interactions - see Overby et al. 2010). In addition, this study suggests that some affordances that have been identified and treated as discrete previously (e.g., Social Connectivity and Control of Interaction, which forms a Relational Escape - see Ellison et al. 2007; Green-Hamann et al. 2011) can be combined to precipitate a particular social outcome. As such, the presented theoretical framework advances our understanding of the IT affordances and constraints related to socialization, introduces greater sophistication by highlighting their

potential dual effects, and enriches our knowledge of intended and unintended ways of using IT, including their positive and negative consequences, which may occur discretely or simultaneously (Majchrzak et al. 2016).

4.5.3 Limitations and Future Research

This study is not without its limitations. First, although I uncovered three variants of IT Escapes that are the major catalysts of Hikikomori development in this study, we must acknowledge that other variants are possible. Indeed, the model in this study suggests that different IT Escapes are especially influential in different stages of the disorder, which can be influenced by a variety of antecedent conditions and manifested in different consequences. As the symptoms of the disorder (see Teo 2010), the traits of the Hikikomoris (see Kato et al. 2019), and the antecedent conditions that precipitate the disorder (see Adamski 2018; Kondo et al. 2013; Teo 2010; Uchida and Norasakkunkit 2015) can all take on a vast array of possible forms, we must acknowledge and caution that this theoretical framework should not be taken to be exhaustive or complete. While it is certainly impossible to capture all possible variants of IT Escapes within a single study (Tan et al. 2015), a study of the potential Escapes that have not uncovered in this research setting would certainly be a fruitful avenue for future research.

Second, although the single case research method is a "typical and legitimate endeavor" in qualitative research (Lee and Baskerville 2003, p. 231), a common criticism of this research approach is the issue of generalizability or external validity (Walsham 2006). In particular, the limitation of generalizability may stem from the singular context (Sarker et al. 2013) of this study. I contend, however, that the findings, arguments and conclusions of this study are nevertheless likely to be generalizable because this study invokes the principles of analytic generalization (see Silva and Hirschheim 2007) or what has been described as "generalizing from description to theory" (Lee and Baskerville 2003, p. 235). In any case, future research can

statistically validate the propositions of this study, so that the boundary conditions of the theoretical framework of this study can be better defined.

4.5.4 Implications for Practice

Beyond its theoretical contributions, this study also has important practical implications for two particular stakeholder groups. First, by specifying the constituent elements of the IT Escapes and revealing their influence of the physical social outcomes on Hikikomori development, this study can be a source of empirically supported prescriptions the stakeholders who help and treat Hikikomoris including many of the informants we interviewed (e.g., key members of the Hikikomori support centers, psychiatrists and caregivers). This is because this study can provide indications on how to mitigate Hikikomori development by shedding light on how IT can contribute to the progression of the disorder, and possibly allow these stakeholders to design and apply the appropriate interventions based on the existing conditions and the stage of the disorder. For example, based on the insight that the Spiritual Escape is acting in tandem with the constraint of Time and Cost Commitments to induce the Complete Physical Isolation of an individual in the Pathological Hikikomori stage, treatments for the disorder can be aimed at diverting the Hikikomoris' attention from their virtual existence, or encouraging them to incorporate a physical dimension to their virtual life (e.g., meeting their online friends physically or even acknowledging their virtual "waifus / husbandos in a physical social setting"). In addition, in terms of designing job training programs for Hikikomori, transferring a severe Hikikomori from a group-focused task that demands multi-tasking and collaboration to a more specialized and repetitive role that does not require the individual to communicate with others could put him/her in a more comfortable environment and nurture their confidence to get back to work gradually. By advancing the understanding of the specific mechanisms through which technology influence the various stages of Hikikomori development can lead to more effective treatments and interventions for the disorder, which

will ultimately alleviate its adverse economic and social consequences such as unemployment (Furlong 2008), suicide, and an overdependence on financial assistance from parents and the social welfare system (Kato et al. 2019).

Second, this study can also provide indications for the practitioners and IT developers who are interested in the development of digital treatment options. For instance, the IT-based treatment options that have been proven ineffective such as that based on Pokémon GO (see Kato et al. 2017) can be redesigned to necessitate physical interactions as part of the game. To prevent the progression of the disorder from the Pre-Hikikomori to the Nascent Hikikomori stage, effort can also be invested in providing digital alternatives to passive Internet consumption and limiting virtual interactions with the aim of preserving physical social participation. Overall, this study could allow this stakeholder group to refine their interventions based on the severity of disorder, and by providing in-depth and precise insights into the influence of IT on Hikikomori development, it is hoped that this study can help these stakeholders to make the most of the efforts and resources invested in the design and development of digital treatment options and, subsequently, realize their fullest potential.

CHAPTER 5: CONCLUSION

5.1 Summary of the Research Questions of the Thesis

Although the use of IT has the potential to adversely affect "the well-being of individuals, organizations and societies" (Tarafdar et al. 2015b, p. 161), the area of dark side outcomes at the hedonic, organizational, and societal levels has remained largely unexplored. The three case studies were conducted to address the research gaps and the research questions set forth at the beginning of this thesis. Although the extant dark side literature theorizes extensively about how individuals are challenged by the use of IT in a work context, there is a general paucity of studies that utilize different levels of analysis, such as hedonic, organizational, and societal, in the IS literature. The research questions set forth at the beginning of this thesis were as follows: (1) *"How do negative implications arise as a result of IT use in a hedonic context?"* (2) *"How do negative implications arise as a result of IT implementation and use at the organizational level?"* and (3) *"How do negative implications arise as a result of IT use at a societal level?"*

5.2 Overall Theoretical Contributions of the Thesis

By addressing the research questions set forth at the beginning of this thesis, this thesis makes several important theoretical contributions. First, based on three case studies, this thesis challenges the existing knowledge in this area, particularly knowledge centered on perspectives at an individual level in a work context, albeit with different lenses, such as technostress (e.g., Ayyagari et al. 2011; Tarafdar et al. 2015a; Tarafdar et al. 2020), IT interruption (e.g., Addas and Pinsonneault 2015; Chen and Karahanna 2014; Gupta et al. 2013a), and IT misuse (e.g., Bulgurcu et al. 2010; D'Arcy and Herath 2011; D'Arcy et al. 2009). Although prior studies have examined the negative impacts of IT use in a work context with an individual level of analysis, the area of dark side outcomes in a hedonic context, at an organizational level, and at a societal level remained largely unexplored. Without addressing these gaps, we could not get a full sense

of the extent of dark side of IT. Taken together with the dark side imperative, the three case studies in this thesis provide three empirically grounded theoretical frameworks respectively that help address the lack of empirical studies on the roles of IT from the dark side of IT research, particularly (1) in a hedonic context with an individual level of analysis, (2) in a work context with an organizational level of analysis, and (3) in a societal context with a societal level of analysis. In doing so, this thesis sheds light on the emerging roles of IT and its unintended implications in response to the call for papers in the *Information Systems Journal* special issue on the "Dark Side of IT Use" (Tarafdar et al. 2015b). Moreover, it is hoped that this thesis can serve as a precedent for future research on the creation of empirically supported models and propositions, so that theoretical advancement can be achieved.

Second, dark side phenomena are associated with various negative outcomes. This thesis suggests three aspects of negative outcomes: individual, organization, and society. Outcomes for individuals in this thesis have included those that are adverse physical, social, and psychological related (Chen and Leung 2016). Organizational outcomes studied in this thesis have included significant financial consequences (Curtis et al. 2012), higher business risk exposure, greater chance of causing project losses, and severe system failures in the future (Ramasubbu and Kemerer 2016). Societal outcomes studied in this thesis have included acute social withdrawal, unemployment (Furlong 2008), as well as an overdependence on financial assistance from their parents and the social welfare system (Kato et al. 2019). There is potential for future research that examines the impact of the individual's experience and behavior on organizational outcomes, such as financial performance, reputation, productivity, and efficiency, as well as societal outcomes, such as disrupted work-life balance, unemployment, and mental disorders.

Third, this thesis challenges the dominant position of existing studies by providing empirical evidence of a process perspective on how the use of IT can result in negative outcomes. Existing IS studies are primarily occupied with the consequences (e.g., Ayyagari et al. 2011; Gupta et al. 2013b) and coping mechanisms (e.g., D'Arcy et al. 2014; Ragu-Nathan et al. 2008; Tarafdar et al. 2015c) of IT use, as well as the statistical correlation between the theoretical constructs (e.g., Tarafdar et al. 2020; Tarafdar et al. 2011; Turel and Serenko 2012; Turel et al. 2011). In constructing detailed theoretical frameworks that identify the mechanisms used to illustrate the dark side of IT in a hedonic context with an individual level of analysis, in a work context with an organizational level of analysis, and in a societal context with a societal level of analysis, this thesis can serve as the basis for developing concrete and testable propositions concerning the negative implications of IT use. For example, the theoretical frameworks developed from the three case studies can be used as measures such as identifying the number of technology design features likely to induce negative outcomes at three different levels. In this way, it is hoped that this thesis can provide a foundation for future research aimed at validating, extending, and establishing the boundary conditions of the thesis' theoretical arguments, and serve as the catalyst for future empirical work in this area, so that in reinforcing the studies that have examined the phenomenon from a higher abstract level, a more holistic perspective of the phenomenon can emerge.

5.2.1 Specific Contributions of the First Case Study

Third, in relation to the first case study, there is scant research to date on the negative implications of IT use in a hedonic context. Instead, extant literature emphasizes the negative effects of IT use in a work context, such as technostress (e.g., Tarafdar et al. 2015c), IT interruption (e.g., Addas and Pinsonneault 2015), and IT misuse (e.g., D'Arcy and Herath 2011). More specifically, Tarafdar et al. (2007) discussed that techno-overload (i.e., information

overload), techno-invasion (i.e., the invasive effect of IT), techno-complexity (i.e., the complex functionalities of IT), techno-insecurity (i.e., feeling insecure when using unfamiliar IT), and techno-uncertainty (i.e., continual IT changes result in feeling unsettled) create technostress. Ragu-Nathan et al. (2008) emphasized that near-continual use of professional IT systems anywhere anytime induces technostress among individuals because they feel forced to multitask, work remotely, and extend their regular workday. Moreover, increased IT usage may facilitate information overload and multitasking. Addas and Pinsonneault (2015) discussed that IT interruptions can create information overload and hinder task performance by overloading individuals with limited attentional resources. Informational overload, in turn, can act as an inhibitor of IT use (Cenfetelli and Schwarz 2011).

In contrast to these predominantly utilitarian perspectives, the study offers a hedonic perspective and reveals that many prescriptions in the work context are not directly applicable to the hedonic context. In particular, although the intrusiveness of professional IT systems can create stress (Tarafdar et al. 2015a), the study reveals that leisure-related IT stimulates excessive usage and gives rise to addiction. For example, the first case study reveals that the instantaneity and perpetual connectedness characteristics of a mobile game amplify the value of convenience (Ko et al. 2009) by enabling individuals to break off and resume play or communication with other players when it suits them (Huang and Hsieh 2011). In contrast to the utilitarian perspective, players appreciate these characteristics, and they constantly seek to satisfy their psychological needs through using them in a hedonic context. As such, the potentially unintended consequences of IT use in a hedonic setting can include addiction.

Fourth, the utilitarian perspectives of technostress, IT interruption, and IT misuse create conditions that impair work performance. For example, the excessive use of work-related IT induces technostress and it manifests in conditions such as role stress (Tarafdar et al. 2007),

decreased job satisfaction (Ragu-Nathan et al. 2008), decreased end user satisfaction with IS (Tarafdar et al. 2010), and work-home conflict (Ayyagari et al. 2011). In particular, work-home conflict refers to the conflict between the demands of work and family (Kreiner 2006). The pervasive effect of IT can be a source of strain because it increasingly breaks the work-life balance by augmenting individuals' time spent on work at home using different devices and applications (Mazmanian et al. 2006). The work-family conflict may create energy drain and subsequent work exhaustion (Ahuja et al. 2007).

The first case study from the hedonic perspective extends and enriches the concept of work-home conflict. While the adverse outcomes from the utilitarian perspective only include the conflict between the demands of professional work and family, the study from the hedonic perspective suggests that the negative implications of addiction involve the conflict between IT use (i.e., mobile gaming) and individuals' overall responsibilities toward physical, social, and psychological well-being. In particular, the first study suggests that addiction forces people to compromise or sacrifice their jobs, educational activities, household responsibilities, interpersonal relationships, and even health and psychological well-being for the sake of gaming (see Chen and Leung 2016).

5.2.2 Specific Contributions of the Second Case Study

Fifth, previous studies have predominantly focused on the adverse outcomes of IT use experienced by individuals (e.g., Bulgurcu et al. 2010; D'Arcy and Herath 2011; D'Arcy et al. 2009), and there has been a lack of research on adverse organizational outcomes. More specifically, D'Arcy et al. (2014) discussed that employee stress caused by uncertain and complex information security requirements can lead to employees' moral disengagement from information security policy violations. Tarafdar et al. (2015a) suggested that excessive IT use

can harm employees' well-being and lead to resignation as they find it too stressful to cope with and learn to use constantly changing workflows/applications.

On the other hand, the second case study suggests that adverse organizational outcomes are not solely the result of employee misconduct but can be driven by the processes undertaken by various stakeholders with diverse interests. Therefore, such outcomes do not only affect employees, but they also have a strong influence on organizations. For example, the study examined digital debt as a specific instance of negative organizational outcomes. Digital debt can generate expensive maintenance costs (Curtis et al. 2012) and unpredictable constraints on future system maintenance, evolvability, and modification (Guo et al. 2016), as well as a decline in system reliability and severe system failures in the future (Ramasubbu and Kemerer 2016). As such, management of adverse organizational outcomes may not only require individual commitment but also the collaboration and cooperation of various stakeholders.

Sixth, IT misuse studies predominantly suggest that individual factors contribute to the negative effects of IT use. For example, D'Arcy et al. (2009) suggested that demographic factors (i.e., age, gender), moral commitment, and perceived severity of sanctions directly influence IT misuse intention. D'Arcy and Herath (2011) argued that an individual's low self-control, overall confidence in his/her ability to use computers or specific IS tasks/applications, and personal moral beliefs have a strong influence on various forms of illicit behavior, including corporate crime.

Beyond individual factors, the second study extends the existing knowledge by revealing that contextual factors of IT use have an important influence on adverse organizational outcomes. As with the individual difference variables, there are numerous triggers, such as paradigm shifts (Tapscott and Caston 1993) and advances in IT, and contextual conditions, such as resource constraints (Woodard et al. 2013) and organizational inertia (adapted from Polites and

Karahanna 2012), that could catalyze the unintended consequences of IT use in companies. While individual factors emphasize that certain individuals are more susceptible to misusing IT and experiencing unintended consequences, contextual factors are particularly salient conditions embedded in an organization that are closely associated with organizational culture (Lucas Jr and Goh 2009) and firm identity (Tripsas 2009).

5.2.3 Specific Contributions of the Third Case Study

Seventh, although there is a growing awareness of the negative societal implications of IT use, such as loneliness, depression (LaRose et al. 2014), loss of productivity, blurred work-life boundaries (e.g., Chen and Karahanna 2018), and addiction (e.g., Tarafdar et al. 2020; Turel 2015), there is a lack of research on societal impacts that goes beyond immediate psychological and behavioral consequences. For example, LaRose et al. (2014) found that connection demands on SNS may create connection overload whereby people struggle with self-control over their connection behaviors. This may consequently lead to negative life outcomes, such as deficient social engagements, loneliness, and depression. Chen and Karahanna (2018) argued that IT interruptions may blur work-life boundaries and lead to psychological and behavioral strain by making people feel drained of emotional and mental energy due to work demands.

The third case study shows that unintended societal impacts can extend to treatment-required mental disorders. For instance, the study examined Hikikomori, characterized by acute social withdrawal, as an extreme form of the negative societal outcomes of IT use. The broader consequences of the increasing Hikikomori phenomenon include unemployment (Furlong 2008), increased suicide rates (Kato et al. 2012), as well as an overdependence on financial assistance from the social welfare system (Kato et al. 2019). As such, management of adverse societal outcomes, both online and offline, requires collaboration between diverse stakeholder

groups to treat the disorder (Tateno et al. 2019) and to alleviate its significant economic and societal impacts (see Furlong 2008; Kato et al. 2019).

Finally, a handful of studies on the negative societal impacts of IT use have examined specific IT artifacts, such as work-related IT (Chen and Karahanna 2018) and SNS (e.g., Tarafdar et al. 2020; Turel 2015). For instance, Tarafdar et al. (2020) argued that stressors from the use of SNS can be associated with addiction through the coping path of distraction within SNS. Turel (2015) discussed that increased SNS use along with ongoing reinforcement of intrinsic rewards can lead to addiction. While prior studies can be a starting point in this direction, focusing on a specific IT artifact may not sufficiently encompass the scope of the various societal implications of IT use.

The third case study reveals that IT affordances can stem from using and interacting with multiple IT artifacts (Markus and Silver 2008). For example, the study suggests that discussion forums, virtual worlds, online games, and SNS are different IT artifacts, but they may share the same affordances, such as social connectivity (see Ellison et al. 2007) and social interactivity (see Wasko et al. 2011). As such, this study suggests that IT affordances and constraints, rather than a single IT artifact, may precipitate excessive dependence on IT that may manifest in acute social withdrawal.

In sum, the key findings and overall theoretical contributions drawn from the three case studies to the dark side literature are summarized in Table 10.

Table 10: Summary of Overall Contributions to the Dark Side Literature				
Overarching Research Questions	**Context / Level of Analysis**	**Negative Implications**	**Study Key Findings**	**Summary of Overall Theoretical Contributions**
Study 1: The Mechanisms of Mobile Gaming Addiction				
How do negative implications arise as a result of IT use in a hedonic context?	Hedonic context / Individual level	Mobile gaming addiction	The Game-Related (i.e., Instantaneity, Perpetual Connectedness, Gameplay Simplicity) and Developmental Characteristics (i.e., Resource Constraints and Iterative Development) of a mobile game may enable the presentation of a number of gaming features (i.e., Constrained Communication, Chance-taking, and Incremental Content Release) from which the underlying three mechanisms of mobile gaming addiction arise: (1) Affective Socialization, (2) Intermittent Reinforcement, and (3) Interest Rejuvenation. The three mechanisms can mutually reinforce one another to amplify their joint effect.	1. Leisure-related IT stimulates excessive usage and gives rise to addiction. In contrast to the utilitarian perspective, players appreciate the IT characteristics of instantaneity and perpetual connectedness, and they constantly seek to satisfy their psychological needs through using them in a hedonic context. 2. Enriches the concept of work-home conflict. While the adverse outcomes from the utilitarian perspective only include the conflict between the demands of professional work and family, this study in a hedonic context suggests that the negative implications of addiction involve the conflict between IT use and individuals' overall responsibilities toward physical, social, and psychological well-being.
Study 2: A Vicious Cycle of Digital Debt Accrual				
How do negative implications arise as a result of IT implementation and use at the	Work context / Organizational level	Digital debt accrual	Triggers of the first stage of digital debt accrual: Paradigm Shift, Mimetic Pressures, and Advances in IT. Catalytic Conditions that are particularly salient to digital debt accrual include Organizational Inertia, Strategic Myopia, Resource Constraints, and Systematic Incomprehension. Stages of digital debt accrual include (1) Coerced	1. Suggests that adverse organizational outcomes are not solely the result of employee misconduct but can be driven by the processes undertaken by various stakeholders with diverse interests. Such outcomes do not only affect employees, but they also have a strong influence on organizations. As such, management of adverse organizational outcomes require the collaboration of various stakeholders.

organizational level?			Outsourcing, (2) Design Economization, (3) Piecemeal Development, and (4) Redundant Concurrency. The dimensions of digital debt include Capability Debt, Functionality Debt, Developmental Debt, and Technical Debt.	2. Beyond individual factors, contextual factors of IT use have an important influence on adverse organizational outcomes. While individual factors emphasize that certain individuals are more susceptible to misusing IT and experiencing unintended consequences, contextual factors are particularly salient conditions embedded in an organization that are closely associated with organizational culture and firm identity.
Study 3: Hikikomori and Technology-Enabled Escapism				
How do negative implications arise as a result of IT use at a societal level?	Societal context / Societal level	Hikikomori development	Antecedent Conditions of Hikikomori development include Internet access, a traumatic childhood experience, disrupted family dynamics, and social conformity and collectivism. IT influences Hikikomori development by presenting affordances that constitute three different forms of IT Escape: (1) Relational Escape, (2) Emotional Escape, and (3) Spiritual Escape. IT constraints include Lack of Corporeality, Absence of Social Cues, and Time and Cost Commitments. Consequently, the Physical Social Outcomes that encompass the unintended consequences of IT use are Virtualization of Social Participation, Withdrawal from Physical Relationships, and Complete Physical Isolation.	1. The unintended societal impacts can extend to treatment-required mental disorders that may lead to unemployment, increased suicide rates, as well as an overdependence on financial assistance from the social welfare system. The management of adverse societal outcomes requires collaboration between diverse stakeholder groups to treat the disorder and to alleviate its significant societal impacts. 2. IT affordances can stem from using and interacting with multiple IT artifacts. While discussion forums, virtual worlds, online games, and SNS are different IT artifacts, they may share the same affordances. As such, IT affordances and constraints, rather than a single IT artifact, may precipitate excessive dependence on IT that may manifest in acute social withdrawal.

5.3 Overall Practical Contributions of the Thesis

Beyond its theoretical implications, this thesis also makes a number of contributions to practice. For gaming addicts, as well as for the family members and rehab centers helping the addicts to overcome their addiction, the first case study is important in that it provides a theoretical framework of the specific constituent elements of the underlying mechanisms of mobile gaming addiction and their influence on the psychological states of gamers. The model developed from the first case study can serve as a detailed roadmap for practitioners through which to understand how the mechanism works, and consequently to identify effective and appropriate interventions to dull the psychological impacts on gamers (see Griffiths 2005). In addition, this study is potentially useful for policymakers who are looking for ways in which they can implement regulations and mitigate the negative implications of mobile gaming addiction, as it helps to identify the adverse impacts of gaming features.

For resource constrained firms, the second case study is significant in that it provides a comprehensive and empirically supported framework for the mitigation of digital debt accrual. More specifically, the theoretical framework developed from the study identifies the crucial triggers and catalytic conditions (e.g., Banker et al. 2020; Kruchten et al. 2012; Lim et al. 2012) of digital debt accrual, and provides important indications on how digital debt, in its various stages, can be accrued in software development settings. Moreover, in tracing the nature and accrual of digital debt, this study is useful for practitioners who are managing digital debt through its identification of ways in which to break the vicious cycle of debt accrual. In particular, it is hoped that practitioners who face difficulty in understanding and mitigating digital debt can use the theoretical framework as a detailed blueprint to assess and identify appropriate remedial actions.

For practitioners who seek to address the adverse economic and social consequences resulting from the increasing number of Hikikomori (Furlong 2008; Kato et al. 2019), the third case study is significant in that it provides a detailed roadmap for Hikikomori development. In particular, the theoretical framework developed in this study is useful as it not only identifies the role of IT on different stages of Hikikomori development, but also specific IT affordances and constraints and their potential physical and social outcomes. This should be especially relevant for practitioners who design effective treatments and interventions for Hikikomori based on the existing conditions and stage of the disorder. Moreover, IT developers who are interested in the development of digital treatment options can use the prescriptions from this thesis to identify the appropriate design and development of digital treatment options, so that they can leverage their existing resources and capabilities and realize their fullest potential.

REFERENCES

Adamski, D. 2018. "The influence of new technologies on the social withdrawal (Hikikomori syndrome) among developed communities, including Poland," *Social Communication* (1:17), pp 58-63.

Addas, S., and Pinsonneault, A. 2015. "The many faces of information technology interruptions: a taxonomy and preliminary investigation of their performance effects," *Information Systems Journal* (25:3), pp 231-273.

Ahuja, M. K., Chudoba, K. M., Kacmar, C. J., McKnight, D. H., and George, J. F. 2007. "IT road warriors: Balancing work-family conflict, job autonomy, and work overload to mitigate turnover intentions," *MIS Quarterly* (31:1), pp 1-17.

Alha, K., Koskinen, E., Paavilainen, J., and Hamari, J. 2019. "Why do people play location-based augmented reality games: A study on Pokémon Go," *Computers in Human Behavior* (93:14), pp 114-122.

Alves, N. S., Mendes, T. S., de Mendonça, M. G., Spínola, R. O., Shull, F., and Seaman, C. 2016. "Identification and management of technical debt: A systematic mapping study," *Information and Software Technology* (70:1), pp 100-121.

Alvesson, M., and Sandberg, J. 2011. "Generating research questions through problematization," *Academy of Management Review* (36:2), pp 247-271.

Anderson, E., Lim, S. Y., and Joglekar, N. 2017. "Are more frequent releases always better? Dynamics of pivoting, scaling, and the minimum viable product," *Proceedings of the 50th Hawaii International Conference on System Sciences*.

Andriole, S. J. 2017. "Five myths about digital transformation," *MIT Sloan Management Review* (58:3), pp 20-22.

Avgeriou, P., Kruchten, P., Ozkaya, I., and Seaman, C. 2016. "Managing technical debt in software engineering," *Dagstuhl Reports* (6:4), pp 110-138.

Ayyagari, R., Grover, V., and Purvis, R. 2011. "Technostress: technological antecedents and implications," *MIS Quarterly* (35:4), pp 831-858.

Baker, J., Jones, D., Cao, Q., and Song, J. 2011. "Conceptualizing the dynamic strategic alignment competency," *Journal of the Association for Information Systems* (12:4), pp 299-322.

Baldwin, C. Y., and Clark, K. B. 1997. "Managing in the age of modularity," *Harvard Business Review* (75:5), pp 84-93.

Bali, M. 2021. "Young Aussies are turning to crypto investment to create wealth, but there's a dark side," (available at https://ab.co/3tU7iXW).

Banker, R., Liang, Y., and Ramasubbu, N. 2020. "Technical debt and firm performance," *Management Science* (66:7), pp 1-21.

Banker, R. D., and Slaughter, S. A. 2000. "The moderating effects of structure on volatility and complexity in software enhancement," *Information Systems Research* (11:3), pp 219-240.

Baumeister, R. F., and Leary, M. R. 1995. "The need to belong: desire for interpersonal attachments as a fundamental human motivation," *Psychological Bulletin* (117:3), pp 497-529.

Belk, R. 2013. "Extended self in a digital world," *Journal of Consumer Research* (40:3), pp 477-500.

Billieux, J. 2012. "Problematic use of the mobile phone: a literature review and a pathways model," *Current Psychiatry Reviews* (8:4), pp 299-307.

Blackburn, T. 2021. "Crypto craze: 4.8 million Aussies to own cryptocurrency this year," (available at https://bit.ly/3bvwMor).

Blaszczynski, A., and Nower, L. 2002. "A pathways model of problem and pathological gambling," *Addiction* (97:5), pp 487-499.

Blinka, L. 2008. "The relationship of players to their avatars in MMORPGs: differences between adolescents, emerging adults and adults," *Cyberpsychology: Journal of Psychosocial Research on Cyberspace* (2:1), pp 1-7.

Boehm, B. 2002. "Get ready for agile methods, with care," *Computer* (35:1), pp 64-69.

Boudreau, K. 2012. "Let a thousand flowers bloom? An early look at large numbers of software app developers and patterns of innovation," *Organization Science* (23:5), pp 1409-1427.

Breen, R. B., and Zuckerman, M. 1999. "Chasing in gambling behavior: personality and cognitive determinants," *Personality and Individual Differences* (27:6), pp 1097-1111.

Brewer, M. 1979. "In-group bias in the minimal intergroup situation: A cognitive-motivational analysis," *Psychological Bulletin* (86:2), pp 307-324.

Brown, C. V., and Vessey, I. 2001. "NIBCO's" Big Bang"," *Communications of the Association for Information Systems* (5:1), pp 1-43.

Brown, N., Cai, Y., Guo, Y., Kazman, R., Kim, M., Kruchten, P., Lim, E., MacCormack, A., Nord, R., and Ozkaya, I. 2010. "Managing technical debt in software-reliant systems," *Proceedings of the FSE/SDP Workshop on Future of Software Engineering Research*.

Bughin, J. 2019. "Next-generation technologies and the next wave of globalization," *McKinsey Global Institute* (available at https://bit.ly/32di1kN).

Bulgurcu, B., Cavusoglu, H., and Benbasat, I. 2010. "Information security policy compliance: an empirical study of rationality-based beliefs and information security awareness," *MIS Quarterly* (34:3), pp 523-548.

Burden, A., Van Der Ouderaa, E., Venkataraman, R., Nyström, T., and Shukla, P. 2018. "Technical debt might be hindering your digital transformation," *MIT Sloan Management Review* (60:1), pp 1-5.

Casey, K. 2020. "What causes technical debt – and how to minimize it," (available at https://red.ht/3oHNVjw).

Cenfetelli, R., and Schwarz, A. 2011. "Identifying and testing the inhibitors of technology usage intentions," *Information Systems Research* (22:4), pp 808-823.

Cerniglia, L., Zoratto, F., Cimino, S., Laviola, G., Ammaniti, M., and Adriani, W. 2017. "Internet addiction in adolescence: Neurobiological, psychosocial and clinical issues," *Neuroscience and Biobehavioral Reviews* (76:19), pp 174-184.

Chan, C. M. L., Teoh, S. Y., Yeow, A., and Pan, G. 2019. "Agility in responding to disruptive digital innovation: Case study of an SME," *Information Systems Journal* (29:2), pp 436-455.

Chappell, D., Eatough, V., Davies, M. N., and Griffiths, M. D. 2006. "EverQuest—It's just a computer game right? An interpretative phenomenological analysis of online gaming addiction," *International Journal of Mental Health and Addiction* (4:3), pp 205-216.

Chen, A., and Karahanna, E. 2014. "Boundaryless technology: Understanding the effects of technology-mediated interruptions across the boundaries between work and personal life," *AIS Transactions on Human-Computer Interaction* (6:2), pp 16-36.

Chen, A., and Karahanna, E. 2018. "Life interrupted: The effects of technology-mediated work interruptions on work and nonwork outcomes," *MIS Quarterly* (42:4), pp 1023-1042.

Chen, C., and Leung, L. 2016. "Are you addicted to Candy Crush Saga? An exploratory study linking psychological factors to mobile social game addiction," *Telematics and Informatics* (33:4), pp 1155-1166.

Chesbrough, H. W. 2003. *Open innovation: The new imperative for creating and profiting from technology*, Harvard Business Press.

Christensen, C., McDonald, R., Altman, E., and Palmer, J. 2018. "Disruptive innovation: An intellectual history and directions for future research," *Journal of Management Studies* (55:7), pp 1043-1078.

Christensen, C., Raynor, M., and McDonald, R. 2015. "What is disruptive innovation," *Harvard Business Review* (93:12), pp 44-53.

Chumbley, J., and Griffiths, M. D. 2006. "Affect and the computer game player: the effect of gender, personality, and game reinforcement structure on affective responses to computer game-play," *CyberPsychology & Behavior* (9:3), pp 308-316.

Chung, J., and Tan, F. B. 2004. "Antecedents of perceived playfulness: an exploratory study on user acceptance of general information-searching websites," *Information & Management* (41:7), pp 869-881.

Cole, H., and Griffiths, M. D. 2007. "Social interactions in massively multiplayer online role-playing gamers," *Cyberpsychology & Behavior* (10:4), pp 575-583.

Coplan, R., and Bowker, J. 2014. "All alone: Multiple perspectives on the study of solitude. ," in *The handbook of solitude: Psychological perspectives on social isolation, social withdrawal, and being alone,* R. Coplan and J. Bowker (eds.), Wiley-Blackwell: UK, pp. 3-13.

Corbin, J., and Janice, M. M. 2003. "The unstructured interactive interview: Issues of reciprocity and risks when dealing with sensitive topics," *Qualitative Inquiry* (9:3), pp 335-354.

Cova, B. 1997. "Community and consumption: Towards a definition of the 'linking value' of product or services," *European Journal of Marketing* (31:3-4), pp 297-316.

Craddock, R. 2019. "Nintendo Tells Mobile Partners To Limit Microtransactions So That Players Don't Spend Too Much," (available at https://bit.ly/35RpcQV).

Cunningham, W. 1992. "The WyCash portfolio management system," *Proceedings on Object-Oriented Programming Systems, Languages, and Applications*.

Curtis, B., Sappidi, J., and Szynkarski, A. 2012. "Estimating the principal of an application's technical debt," *IEEE Software* (29:6), pp 34-42.

Cyr, D., Head, M., and Ivanov, A. 2006. "Design aesthetics leading to m-loyalty in mobile commerce," *Information & Management* (43:8), pp 950-963.

D'Arcy, J., and Devaraj, S. 2012. "Employee misuse of information technology resources: Testing a contemporary deterrence model," *Decision Sciences* (43:6), pp 1091-1124.

D'Arcy, J., and Herath, T. 2011. "A review and analysis of deterrence theory in the IS security literature: making sense of the disparate findings," *European Journal of Information Systems* (20:6), pp 643-658.

D'Arcy, J., Herath, T., and Shoss, M. 2014. "Understanding employee responses to stressful information security requirements: A coping perspective," *Journal of Management Information Systems* (31:2), pp 285-318.

D'Arcy, J., Hovav, A., and Galletta, D. 2009. "User awareness of security countermeasures and its impact on information systems misuse: A deterrence approach," *Information Systems Research* (20:1), pp 79-98.

D'Aveni, R. A., Dagnino, G. B., and Smith, K. G. 2010. "The age of temporary advantage," *Strategic Management Journal* (31:13), pp 1371-1385.

Dacin, M., Munir, K., and Tracey, P. 2010a. "Formal dining at Cambridge colleges: Linking ritual performance and institutional maintenance," *Academy of Management Journal* (53:6), pp 1393-1418.

Dacin, M. T., Munir, K., and Tracey, P. 2010b. "Formal dining at Cambridge colleges: Linking ritual performance and institutional maintenance," *Academy of Management Journal* (53:6), pp 1393-1418.

Dalal, V., Krishnakanthan, K., Munstermann, B., and Patenge, R. 2020. "Tech debt: Reclaiming tech equity," (available at https://mck.co/39rtW2Y).

Deng, X., Joshi, K., and Galliers, R. 2016. "The duality of empowerment and marginalization in microtask crowdsourcing: Giving voice to the less powerful through value sensitive design," *MIS Quarterly* (40:2), pp 279-302.

DiMaggio, P. J., and Powell, W. W. 1983. "The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields," *American Sociological Review* (48:2), pp 147-160.

Doi, T. 1973. *The anatomy of dependence*, Kodansha International: Tokyo.

Ellison, N. B., Steinfield, C., and Lampe, C. 2007. "The benefits of Facebook "friends:" Social capital and college students' use of online social network sites," *Journal of Computer-Mediated Communication* (12:4), pp 1143-1168.

Fang, B., Zheng, Z., Ye, Q., and Goes, P. B. 2019. "Social Influence and Monetization of Freemium Social Games," *Journal of Management Information Systems* (36:3), pp 730-754.

Faraj, S., and Azad, B. 2012. "The materiality of technology: An affordance perspective," in *Materiality and Organizing: Social Interaction in a Technological World,* P. M. Leonardi, B. A. Nardi and J. Kallinikos (eds.), Oxford University Press: Oxford, UK, pp. 237-258.

Ferlie, E., Fitzgerald, L., Wood, M., and Hawkins, C. 2005. "The nonspread of innovations: The mediating role of professionals," *Academy of Management Journal* (48:1), pp 117-134.

Fowler, M. 2009. "Technical Debt Quadrant," (available at https://bit.ly/3cD4syW).

Frankova, I. 2019. "Similar but different. Psychological and psychopathological features of primary and secondary hikikomori," *Frontiers in Psychiatry* (10:558), pp 1-7.

Furlong, A. 2008. "The Japanese hikikomori phenomenon: acute social withdrawal among young people," *The Sociological Review* (56:2), pp 309-325.

Gent, E. 2019. "The plight of Japan's modern hermits," (available at https://bbc.in/3cIKUZB).

Gerring, J. 2009. "Case selection for case - study analysis: Qualitative and quantitative techniques," *The Oxford Handbook of Political Methodology* (available at https://bit.ly/2VXXIGc).

Gholami, M. F., Daneshgar, F., Beydoun, G., and Rabhi, F. 2017. "Challenges in migrating legacy software systems to the cloud—an empirical study," *Information Systems* (67:7), pp 100-113.

Gibson, J. 1986. *The ecological approach to visual perception.*, Lawrence Erlbaum Associates: NJ.

Gilbert, R. L., Murphy, N. A., and Ávalos, M. C. 2011. "Realism, idealization, and potential negative impact of 3D virtual relationships," *Computers in Human Behavior* (27:5), pp 2039-2046.

Glaser, B. 1992. *Basics of grounded theory analysis: Emergence vs. forcing*, Sociology Press: Mill Valley, CA.

Glaser, B., and Strauss, A. 1967. "Grounded theory: The discovery of grounded theory," *Sociology the Journal of the British Sociological Association* (12:1), pp 27-49.

Goh, S., and Wasko, M. 2012. "The Effects of Leader-Member Exchange on Member Performance in Virtual World Teams," *Journal of the Association for Information Systems* (13:10), pp 861-885.

Green-Hamann, S., Campbell Eichhorn, K., and Sherblom, J. C. 2011. "An exploration of why people participate in Second Life social support groups," *Journal of Computer-Mediated Communication* (16:4), pp 465-491.

Gregory, R. W., Keil, M., Muntermann, J., and Mähring, M. 2015. "Paradoxes and the nature of ambidexterity in IT transformation programs," *Information Systems Research* (26:1), pp 57-80.

Griffiths, M. D. 1990. "Psychobiology of the near-miss in fruit machine gambling," *The Journal of Psychology* (125:3), pp 347-357.

Griffiths, M. D. 2005. "A "components" model of addiction within a biopsychosocial framework," *Journal of Substance Use* (10:4), pp 191-197.

Griffiths, M. D. 2008. "Videogame addiction: Further thoughts and observations," *International Journal of Mental Health and Addiction* (6:2), pp 182-185.

Griffiths, M. D. 2013. "Social gambling via Facebook: Further observations and concerns," *Gaming Law Review and Economics* (17:2), pp 104-106.

Griffiths, M. D. 2018. "Is the buying of loot boxes in video games a form of gambling or gaming?," *Gaming Law Review* (22:1), pp 52-54.

Griffiths, M. D., Davies, M. N., and Chappell, D. 2004. "Demographic factors and playing variables in online computer gaming," *CyberPsychology & Behavior* (7:4), pp 479-487.

Guo, Y., and Seaman, C. 2011. "A portfolio approach to technical debt management," *Proceedings of the 2nd Workshop on Managing Technical Debt, International Conference on Software Engineering*.

Guo, Y., Spínola, R. O., and Seaman, C. 2016. "Exploring the costs of technical debt management–a case study," *Empirical Software Engineering* (21:1), pp 159-182.

Gupta, A., Li, H., and Sharda, R. 2013a. "Should I send this message? Understanding the impact of interruptions, social hierarchy and perceived task complexity on user performance and perceived workload," *Decision Support Systems* (55:1), pp 135-145.

Gupta, A., Sharda, R., Dong, Y., Sharda, R., Asamoah, D., and Pickering, B. 2013b. "Improving rounding in critical care environments through management of interruptions," *Decision Support Systems* (55:2), pp 516-527.

Ha, I., Yoon, Y., and Choi, M. 2007. "Determinants of adoption of mobile games under mobile broadband wireless access environment," *Information & Management* (44:3), pp 276-286.

Hamari, J., Malik, A., Koski, J., and Johri, A. 2018. "Uses and gratifications in Pokemon Go: Why do people play mobile location-based augmented reality games?," *International Journal of Human-computer Interaction* (35:9), pp 1-16.

Hess, T., Matt, C., Benlian, A., and Wiesböck, F. 2016. "Options for formulating a digital transformation strategy," *MIS Quarterly Executive* (15:2), pp 123-139.

Hoggins, T. 2019. "World Health Organisation adopts 'gaming addiction' as official illness despite industry opposition," The Telegraph.

Holton, J. 2010. "The coding process and its challenges. ," *The Grounded Theory Review* (9:1), pp 21-40.

Hsiao, C., and Chiou, J. 2012. "The impact of online community position on online game continuance intention: Do game knowledge and community size matter?," *Information & Management* (49:6), pp 292-300.

Hsu, C. L., and Lu, H. P. 2004. "Why do people play on-line games? An extended TAM with social influences and flow experience," *Information & Management* (41:7), pp 853-868.

Hsu, T. 2018. "Video Game Addiction Tries to Move From Basement to Doctor's Office," (available at https://nyti.ms/3bulC01).

Huang, L. Y., and Hsieh, Y. J. 2011. "Predicting online game loyalty based on need gratification and experiential motives," *Internet Research* (21:5), pp 581-598.

Jeong, E. J., and Kim, D. H. 2011. "Social activities, self-efficacy, game attitudes, and game addiction," *Cyberpsychology, Behavior, and Social Networking* (14:4), pp 213-221.

Jeong, E. J., and Kim, D. J. 2009. *Definitions, key characteristics, and generations of mobile games*, IGI Global: Hershey, PA.

Jerolmack, C., and Khan, S. 2014. "Talk is cheap: Ethnography and the attitudinal fallacy," *Sociological Methods & Research* (43:2), pp 178-209.

Jiang, L., Lowry, P. B., and Wagner, C. 2014. "Understanding contributor withdrawal from online communities: The role of cognitive dissonance and emotional change," *Proceedings of the Journal of the Association for Information Systems Theory Development Workshop at the International Conference on Information Systems*.

Junglas, I., Goel, L., Abraham, C., and Ives, B. 2013. "The social component of information systems— How sociability contributes to technology acceptance," *Journal of the Association for Information Systems* (14:10), pp 585-616.

Kahre, C., Hoffmann, D., and Ahlemann, F. 2017. "Beyond business-IT alignment-digital business strategies as a paradigmatic shift: a review and research agenda," in *Hawaii International Conference on System Sciences*: Waikoloa Beach, Hawaii, pp. 4706-4715.

Kaplan, A., and Haenlein, M. 2010. "Users of the world, unite! The challenges and opportunities of Social Media," *Business Horizons* (53:1), pp 59-68.

Kato, T., Kanba, S., and Teo, A. 2018. "Hikikomori: experience in Japan and international relevance," *World Psychiatry* (17:1), pp 105-106.

Kato, T., Kanba, S., and Teo, A. 2019. "Hikikomori: Multidimensional understanding, assessment, and future international perspectives," *Psychiatry and Clinical Neurosciences* (73:8), pp 427-440.

Kato, T., Kanba, S., and Teo, A. 2020. "Defining pathological social withdrawal: proposed diagnostic criteria for hikikomori," *World Psychiatry* (19:1), pp 116-117.

Kato, T., Tateno, M., Shinfuku, N., Fujisawa, D., Teo, A., Sartorius, N., Akiyama, T., Ishida, T., Choi, T. Y., and Balhara, Y. P. S. 2012. "Does the 'hikikomori'syndrome of social withdrawal exist outside Japan? A preliminary international investigation," *Social Psychiatry and Psychiatric Epidemiology* (47:7), pp 1061-1075.

Kato, T., Teo, A., Tateno, M., Watabe, M., Kubo, H., and Kanba, S. 2017. "Can Pokémon GO rescue hikikomori from their isolated world," *Psychiatry Clinical Neuroscience* (71:1), pp 75-76.

Kawachi, I., and Berkman, L. 2001. "Social ties and mental health," *Journal of Urban Health* (78:3), pp 458-467.

Keen, P. 1991. *Shaping the future: Business design through information technology*.

Keogh, B., and Richardson, I. 2018. "Waiting to play: The labour of background games," *European Journal of Cultural Studies* (21:1), pp 13-25.

Kim, S. L., Suk, H. J., Kang, J. H., Jung, J. M., Laine, T. H., and Westlin, J. 2014. "Using Unity 3D to facilitate mobile augmented reality game development," *IEEE World Forum on Internet of Things*.

King, D., and Delfabbro, P. 2009. "Motivational differences in problem video game play," *Journal of Cybertherapy and Rehabilitation* (2:2), pp 139-149.

King, D., Delfabbro, P., and Griffiths, M. D. 2010. "Video game structural characteristics: A new psycho-logical taxonomy," *International Journal of Mental Health and Addiction* (8:1), pp 90-106.

King, D., Delfabbro, P. H., and Griffiths, M. D. 2011. "The role of structural characteristics in problematic video game play: An empirical study," *International Journal of Mental Health and Addiction* (9:3), pp 320-333.

King, D., Gainsbury, S. M., Delfabbro, P. H., Hing, N., and Abarbanel, B. 2015. "Distinguishing between gaming and gambling activities in addiction research," *Journal of Behavioral Addictions* (4:4), pp 215-220.

Klein, H. K., and Myers, M. D. 1999. "A set of principles for conducting and evaluating interpretive field studies in information systems," *MIS Quarterly* (23:1), pp 67-93.

Ko, E., Kim, E. Y., and Lee, E. K. 2009. "Modeling consumer adoption of mobile shopping for fashion products in Korea," *Psychology and Marketing* (26:7), pp 669-687.

Kobayashi, S., Yoshida, K., Noguchi, H., Tuchiya, T., and Ito, J. 2003. "Research for parents of children with "social withdrawal"," *Clinical Psychiatry* (45:3), pp 749-756.

Kohli, R., and Johnson, S. 2011. "Digital transformation in latecomer industries: CIO and CEO leadership lessons from Encana Oil & Gas (USA) Inc," *MIS Quarterly Executive* (10:4), pp 141-156.

Kondo, N., Sakai, M., Kuroda, Y., Kiyota, Y., Kitabata, Y., and Kurosawa, M. 2013. "General condition of hikikomori (prolonged social withdrawal) in Japan: psychiatric diagnosis and outcome in mental health welfare centres," *International Journal of Social Psychiatry* (59:1), pp 79-86.

Koyama, A., Miyake, Y., Kawakami, N., Tsuchiya, M., Tachimori, H., and Takeshima, T. 2010. "Lifetime prevalence, psychiatric comorbidity and demographic correlates of hikikomori in a community population in Japan," *Psychiatry Research* (176:1), pp 69-74.

Kozinets, R. 2002. "The field behind the screen: Using netnography for marketing research in online communities," *Journal of Marketing Research* (39:1), pp 61-72.

Kozinets, R. 2015. *Netnography: Redefined*, SAGE: London.

Kozinets, R. V. 2006. "Click to connect: Netnography and tribal advertising," *Journal of Advertising Research* (46:3), pp 279-288.

Kreiner, G. E. 2006. "Consequences of work-home segmentation or integration: A person-environment fit perspective," *Journal of Organizational Behavior* (27:4), pp 485-507.

Kruchten, P., Nord, R., and Ozkaya, I. 2012. "Technical debt: From metaphor to theory and practice," *IEEE Software* (29:6), pp 18-21.

Kruchten, P., Nord, R., and Ozkaya, I. 2019. *Managing technical debt: Reducing friction in software development*, Addison-Wesley Professional.

Kruchten, P., Nord, R. L., Ozkaya, I., and Falessi, D. 2013. "Technical debt: Towards a crisper definition report on the 4th international workshop on managing technical debt," *ACM SIGSOFT Software Engineering Notes* (38:5), pp 51-54.

Kuss, D. J. 2013. "Internet gaming addiction: current perspectives," *Psychology Research and Behavior Management* (6:1), pp 125-137.

Kwon, H. E., So, H., Han, S. P., and Oh, W. 2016. "Excessive dependence on mobile social apps: A rational addiction perspective," *Information Systems Research* (27:4), pp 919-939.

Lacity, M. C., Khan, S. A., and Willcocks, L. P. 2009. "A review of the IT outsourcing literature: Insights for practice," *The Journal of Strategic Information Systems* (18:3), pp 130-146.

Langley, A. 1999. "Strategies for theorizing from process data," *Academy of Management Review* (24:4), pp 691-710.

LaRose, R., Connolly, R., Lee, H., Li, K., and Hales, K. D. 2014. "Connection overload? A cross cultural study of the consequences of social media connection," *Information Systems Management* (31:1), pp 59-73.

LaRose, R., Kim, J., and Peng, W. 2011. "Social networking: Addictive, compulsive, problematic, or just another media habit?," in *A networked self. Identity, Community, and Culture on Social Network Sites,* Z. Papacharissi (ed.), Routledge: New York and London, pp. 59-81.

Lee, A., and Baskerville, R. L. 2003. "Generalizing generalizability in information systems research," *Information Systems Research* (14:3), pp 221-243.

Lee, G., and Raghu, T. S. 2014. "Determinants of mobile apps' success: Evidence from the app store market," *Journal of Management Information Systems* (31:2), pp 133-170.

Lemmens, J. S., Valkenburg, P. M., and Peter, J. 2009. "Development and validation of a game addiction scale for adolescents," *Media Psychology* (12:1), pp 77-95.

Leonardi, P. M. 2007. "Activating the informational capabilities of information technology for organizational change," *Organization Science* (18:5), pp 813-831.

Leonardi, P. M. 2011. "When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies," *MIS Quarterly* (35:1), pp 147-167.

Li, Z., Avgeriou, P., and Liang, P. 2015. "A systematic mapping study on technical debt and its management," *Journal of Systems and Software* (101:15), pp 193-220.

Liang, H., Saraf, N., Hu, Q., and Xue, Y. 2007. "Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management," *MIS Quarterly* (31:1), pp 59-87.

Liang, H., and Xue, Y. 2004. "Coping with ERP-related contextual issues in SMEs: A vendor's perspective," *The Journal of Strategic Information Systems* (13:4), pp 399-415.

Liang, T., and Yeh, Y. 2011. "Effect of use contexts on the continuous use of mobile services: the case of mobile games," *Personal and Ubiquitous Computing* (15:2), pp 187-196.

Lim, E., Taksande, N., and Seaman, C. 2012. "A balancing act: What software practitioners have to say about technical debt," *IEEE Software* (29:6), pp 22-27.

Limayem, M., Hirt, S. G., and Cheung, C. M. 2007. "How habit limits the predictive power of intention: The case of information systems continuance," *MIS Quarterly* (31:4), pp 705-737.

Liu, C., Au, Y., and Choi, H. S. 2012. "An empirical study of the freemium strategy for mobile apps: Evidence from the google play market," in *International Conference on Information Systems*: Orlando.

Liu, D., Li, X., and Santhanam, R. 2013. "Digital Games and Beyond: What Happens When Players Compete?," *MIS Quarterly* (37:1), pp 111-124.

Loh, L., and Venkatraman, N. 1992. "Diffusion of information technology outsourcing: Influence sources and the Kodak effect," *Information Systems Research* (3:4), pp 334-358.

Lucas Jr, H., and Goh, J. M. 2009. "Disruptive technology: How Kodak missed the digital photography revolution," *The Journal of Strategic Information Systems* (18:1), pp 46-55.

Lucas, K., and Sherry, J. L. 2004. "Sex differences in video game play: A communication-based explanation," *Communication Research* (31:5), pp 499-523.

Mabert, V. A., Soni, A., and Venkataramanan, M. 2003. "Enterprise resource planning: Managing the implementation process," *European Journal of Operational Research* (146:2), pp 302-314.

MacCallum-Stewart, E., and Parsler, J. 2008. *Role-Play vs. Gameplay: The Difficulties of Playing a Role in World of Warcraft*, MIT Press: Cambridge.

Majchrzak, A., Faraj, S., Kane, G., and Azad, B. 2013. "The contradictory influence of social media affordances on online communal knowledge sharing," *Journal of Computer-Mediated Communication* (19:1), pp 38-55.

Majchrzak, A., and Markus, L. 2012. *Technology affordances and constraints in management information systems*, Social Science Research Network: Rochester, NY.

Majchrzak, A., Markus, L., and Wareham, J. 2016. "Designing for digital transformation: Lessons for information systems research from the study of ICT and societal challenges," *MIS Quarterly* (40:2), pp 267-277.

Majchrzak, A., Markus, M. L., and Wareham, J. 2012. "ICT and societal challenges," *MISQ Special Issue Call for Papers*).

Malaurent, J., and Karanasios, S. 2020. "Learning from workaround practices: The challenge of enterprise system implementations in multinational corporations," *Information Systems Journal* (30:4), pp 639-663.

Marinescu, R. 2012. "Assessing technical debt by identifying design flaws in software systems," *IBM Journal of Research and Development* (56:5), pp 1-13.

Markus, L., and Mentzer, K. 2014. "Foresight for a responsible future with ICT," *Information Systems Frontiers* (16:3), pp 353-368.

Markus, M. L., and Silver, M. S. 2008. "A foundation for the study of IT effects: A new look at DeSanctis and Poole's concepts of structural features and spirit," *Journal of the Association for Information Systems* (9:10), pp 609-632.

Matook, S., Cummings, J., and Bala, H. 2015. "Are you feeling lonely? The impact of relationship characteristics and online social network features on loneliness," *Journal of Management Information Systems* (31:4), pp 278-310.

Mazmanian, M., Yates, J., and Orlikowski, W. 2006. "Ubiquitous email: Individual experiences and organizational consequences of Blackberry use," *Academy of Management Proceedings*.

McCambridge, J., Witton, J., and Elbourne, D. 2014. "Systematic review of the Hawthorne effect: new concepts are needed to study research participation effects," *Journal of Clinical Epidemiology* (67:3), pp 267-277.

McClure, D. 2018. "Measuring technical debt," (available at https://accntu.re/3ci3RW1).

McConnell, S. 2008. "Managing technical debt " (available at https://bit.ly/3cMxazH).

Merikivi, J., Tuunainen, V., and Nguyen, D. 2017. "What makes continued mobile gaming enjoyable?," *Computers in Human Behavior* (68:40), pp 411-421.

Milosevic, M., Zivic, N., and Andjelkovic, I. 2017. "Early churn prediction with personalized targeting in mobile social games," *Expert Systems With Applications* (83:26), pp 326-332.

Miranda, S., Young, A., and Yetgin, E. 2016. "Are social media emancipatory or hegemonic? Societal effects of mass media digitization in the case of the SOPA discourse," *MIS Quarterly* (40:2), pp 303-329.

Mitrou, L., Kandias, M., Stavrou, V., and Gritzalis, D. 2014. "Social media profiling: A Panopticon or Omniopticon tool?," *Proceedings of the 6th Conference of the Surveillance Studies Network*.

Myers, M. D., and Newman, M. 2007. "The qualitative interview in IS research: Examining the craft," *Information & Organization* (17:1), pp 2-26.

Nagata, T., Yamada, H., Teo, A., Yoshimura, C., Nakajima, T., and Van Vliet, I. 2013. "Comorbid social withdrawal (hikikomori) in outpatients with social anxiety disorder: clinical characteristics and treatment response in a case series," *International Journal of Social Psychiatry* (59:1), pp 73-78.

Nandhakumar, J., Panourgias, N., and Scarbrough, H. 2013. "From knowing it to "getting it": Envisioning practices in computer games development," *Information Systems Research* (24:4), pp 933-955.

Norman, D. A. 1988. *The psychology of everyday things*, Basic books.

Overby, E., Slaughter, S., and Konsynski, B. 2010. "Research commentary—the design, use, and consequences of virtual processes," *Information Systems Research* (21:4), pp 700-710.

Pan, S. L., and Tan, B. 2011. "Demystifying case research: A structured-pragmatic-situational (SPS) approach to conducting case studies," *Information & Organization* (21:3), pp 161-176.

Park, E., Baek, S., Ohm, J., and Chang, H. J. 2014. "Determinants of player acceptance of mobile social network games: An application of extended technology acceptance model," *Telematics and Informatics* (31:1), pp 3-15.

Park, Y., Pavlou, P. A., and Saraf, N. 2020. "Configurations for achieving organizational ambidexterity with digitization," *Information Systems Research* (31:4), pp 1376-1397.

Polites, G., and Karahanna, E. 2012. "Shackled to the status quo: The inhibiting effects of incumbent system habit, switching costs, and inertia on new system acceptance," *MIS Quarterly* (36:1), pp 21-42.

Porra, J., Hirschheim, R., and Parks, M. S. 2014. "The historical research method and information systems research," *Journal of the Association for Information Systems* (15:9), pp 536-576.

Porter, C. E., Donthu, N., MacElroy, W., and Wydra, D. 2011. "How to foster and sustain engagement in virtual communities," *California Management Review* (53:4), pp 80-110.

Ragu-Nathan, T., Tarafdar, M., Ragu-Nathan, B., and Tu, Q. 2008. "The consequences of technostress for end users in organizations: Conceptual development and empirical validation," *Information Systems Research* (19:4), pp 417-433.

Ramasubbu, N., and Kemerer, C. 2014. "Managing technical debt in enterprise software packages," *IEEE Transactions on Software Engineering* (40:8), pp 758-772.

Ramasubbu, N., and Kemerer, C. 2016. "Technical debt and the reliability of enterprise software systems: A competing risks analysis," *Management Science* (62:5), pp 1487-1510.

Ramasubbu, N., Kemerer, C., and Hong, J. 2011. "Structural complexity and programmer team strategy: An experimental test," *IEEE Transactions on Software Engineering* (38:5), pp 1054-1068.

Rauschnabel, P., Rossmann, A., and Dieck, M. C. 2017. "An adoption framework for mobile augmented reality games: The case of Pokemon Go," *Computers in Human Behavior* (76:29), pp 276-286.

Ravaja, N., Turpeinen, M., Saari, T., Puttonen, S., and Keltikangas-Järvinen, L. 2008. "The psychophysiology of James Bond: Phasic emotional responses to violent video game events," *Emotion* (8:1), pp 114-120.

Rayport, J., and Sviokla, J. 1995. "Exploiting the virtual value chain," *Harvard Business Review* (73:6), pp 75-84.

Ries, E. 2011. *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*.

Rigby, J., Brumby, D., Cox, A., and Gould, S. 2016. "Watching movies on netflix: investigating the effect of screen size on viewer immersion," *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct*.

Rockloff, M. J., and Dyer, V. 2007. "An experiment on the social facilitation of gambling behavior," *Journal of Gambling Studies* (23:1), pp 1-12.

Rolland, K., Mathiassen, L., and Rai, A. 2018. "Managing digital platforms in user organizations: the interactions between digital options and digital debt," *Information Systems Research* (29:2), pp 419-443.

Ross, S. 2018. "Small Giant Games announces epic expansion to hit franchise Empires & Puzzles," (available at https://bwnews.pr/2Iv5b7N).

Rynes, S., and Gephart, R. P., Jr. 2004. "From the editors: Qualitative research and the Academy of Management Journal," *Academy of Management Journal* (47:4), pp 454-462.

Saito, T. 1998. *Social withdrawal: a neverending adolescence*, PHP Kenkyujo: Japan.

Saito, T. 2019. "Japan's "Hikikomori" Population Could Top 10 Million," (available at https://bit.ly/2yE0qr1).

Salen, K., Tekinbaş, K. S., and Zimmerman, E. 2004. *Rules of play: Game design fundamentals*, MIT press.

Sambamurthy, V., Bharadwaj, A., and Grover, V. 2003. "Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms," *MIS Quarterly* (27:2), pp 237-263.

Sarker, S., Sarker, S., Sahaym, A., and Bjørn-Andersen, N. 2012. "Exploring value cocreation in relationships between an ERP vendor and its partners: a revelatory case study," *MIS Quarterly* (36:1), pp 317-338.

Sarker, S., Xiao, X., and Beaulieu, T. 2013. "Qualitative studies in information systems: A critical review and some guiding principles," *MIS Quarterly* (37:4), pp iii-xviii.

Schultze, U., and Orlikowski, W. 2010. "Research commentary-Virtual worlds: A performative perspective on globally distributed, immersive work," *Information Systems Research* (21:4), pp 810-821.

Seacord, R. C., Plakosh, D., and Lewis, G. A. 2003. *Modernizing legacy systems: Software technologies, engineering processes, and business practices*, Addison-Wesley Professional.

Seaman, C., and Guo, Y. 2011. "Measuring and monitoring technical debt," in *Advances in Computers*, Elsevier, pp. 25-46.

Shah, S. 2018. "Gaming addicts reveal how the obsession destroyed their lives," (available at https://bit.ly/3aCyrWe).

Shibuya, A., Teramoto, M., and Shoun, A. 2015. "Systematic Analysis of In-Game Purchases and Social Features of Mobile Social Games," in *Digital Games Research Association Conference*.

Silva, L., and Hirschheim, R. 2007. "Fighting against windmills: Strategic information systems and organizational deep structures," *MIS Quarterly* (31:2), pp 327-354.

Smahel, D., Blinka, L., and Ledabyl, O. 2008. "Playing MMORPGs: Connections between addiction and identifying with a character," *CyberPsychology & Behavior* (11:6), pp 715-718.

Smith, W. K., and Lewis, M. W. 2011. "Toward a theory of paradox: A dynamic equilibrium model of organizing," *Academy of Management Review* (36:2), pp 381-403.

Srivastava, S. C., and Shainesh, G. 2015. "Bridging the service divide through digitally enabled service innovations," *MIS Quarterly* (39:1), pp 245-268.

Stavropoulos, V., Anderson, E., Beard, C., Latifi, M., Kuss, D., and Griffiths, M. D. 2019. "A preliminary cross-cultural study of Hikikomori and Internet Gaming Disorder: The moderating effects of game-playing time and living with parents," *Addictive Behaviors Reports* (9:100137), pp 1-10.

Stip, E., Thibault, A., Beauchamp-Chatel, A., and Kisely, S. 2016. "Internet addiction, hikikomori syndrome, and the prodromal phase of psychosis," *Frontiers in Psychiatry* (7:6), pp 1-8.
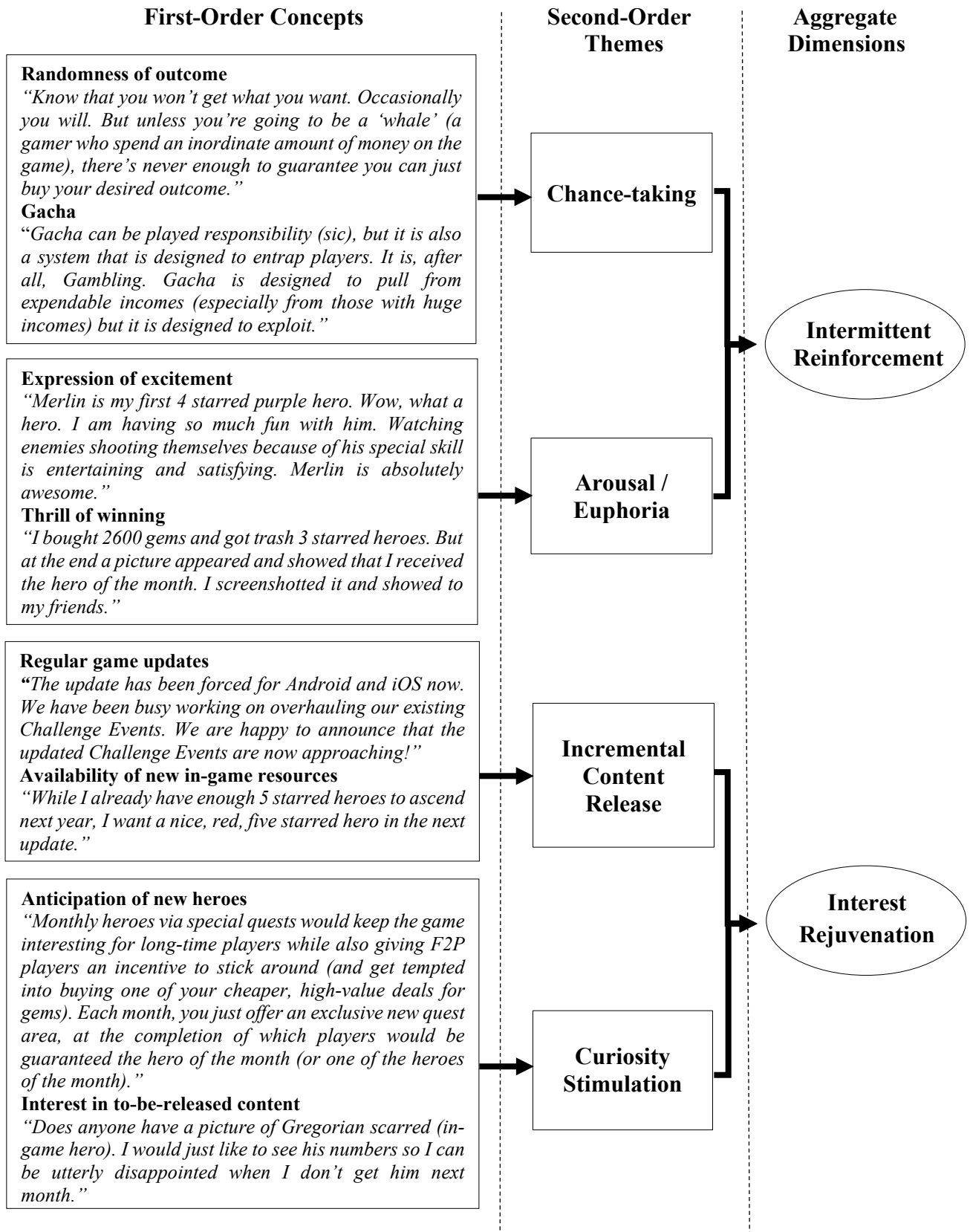
Strauss, A., and Corbin, J. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, (2nd ed.) Sage: Thousand Oaks, CA.

Sun, Y., Zhao, Y., Jia, S. Q., and Zheng, D. Y. 2015. "Understanding the antecedents of mobile game addiction: The roles of perceived visibility, perceived enjoyment and flow," *PACIS*.

Szmigin, I., Canning, L., and Reppel, A. 2005. "Online community: Enhancing the relationship marketing concept through customer bonding," *International Journal of Service Industry Management* (16:5), pp 480-496.

Tallon, P., and Pinsonneault, A. 2011. "Competing Perspectives on the Link Between Strategic Information Technology Alignment and Organizational Agility: Insights from a Mediation Model," *MIS Quarterly* (35:2), pp 463-486.

Tan, B., Pan, S. L., Lu, X., and Huang, L. 2015. "The Role of IS Capabilities in the Development of Multi-sided Platforms: The Digital Ecosystem Strategy of Alibaba.com," *Journal of the Association for Information Systems* (16:4), pp 248-280.

Tanis, M., and Postmes, T. 2003. "Social cues and impression formation in CMC," *Journal of Communication* (53:4), pp 676-693.

Tapscott, D., and Caston, A. 1993. *Paradigm shift: The new promise of information technology*, McGraw-Hill: New York, USA.

Tarafdar, M., D'Arcy, J., Turel, O., and Gupta, A. 2015a. "The dark side of information technology," *MIT Sloan Management Review* (56:2), pp 61-70.

Tarafdar, M., Gupta, A., and Turel, O. 2015b. "Special issue on 'dark side of information technology use': an introduction and a framework for research," *Information Systems Journal* (25:3), pp 161-170.

Tarafdar, M., Maier, C., Laumer, S., and Weitzel, T. 2020. "Explaining the link between technostress and technology addiction for social networking sites: A study of distraction as a coping behavior," *Information Systems Journal* (30:1), pp 96-124.

Tarafdar, M., Pullins, E. B., and Ragu-Nathan, T. 2015c. "Technostress: Negative effect on performance and possible mitigations," *Information Systems Journal* (25:2), pp 103-132.

Tarafdar, M., Tu, Q., Ragu-Nathan, B. S., and Ragu-Nathan, T. 2007. "The impact of technostress on role stress and productivity," *Journal of Management Information Systems* (24:1), pp 301-328.

Tarafdar, M., Tu, Q., and Ragu-Nathan, T. 2010. "Impact of technostress on end-user satisfaction and performance," *Journal of Management Information Systems* (27:3), pp 303-334.

Tarafdar, M., Tu, Q., Ragu-Nathan, T., and Ragu-Nathan, B. 2011. "Crossing to the dark side: examining creators, outcomes, and inhibitors of technostress," *Communications of the ACM* (54:9), pp 113-120.

Tateno, M., Teo, A., Ukai, W., Kanazawa, J., Katsuki, R., Kubo, H., and Kato, T. 2019. "Internet addiction, smartphone addiction, and Hikikomori trait in Japanese young adult: Social isolation and social network," *Frontiers in Psychiatry* (10:455), pp 1-11.

Taylor, T. L. 2009. *Play between worlds: Exploring online game culture*, MIT Press.

Teng, C. 2017. "Impact of avatar identification on online gamer loyalty: Perspectives of social identity and social capital theories," *International Journal of Information Management* (37:6), pp 601-610.

Teo, A. 2010. "A new form of social withdrawal in Japan: a review of hikikomori," *International Journal of Social Psychiatry* (56:2), pp 178-185.

Teo, A., Fetters, M., Stufflebam, K., Tateno, M., Balhara, Y., Choi, T., Kanba, S., Mathews, C., and Kato, T. 2015. "Identification of hikikomori syndrome of social withdrawal: psychosocial features and treatment preferences in four countries," *International Journal of Social Psychiatry* (61:1), pp 64-72.

Teo, A., and Gaw, A. 2010. "Hikikomori, a Japanese culture-bound syndrome of social withdrawal? A proposal for DSM-5," *Journal of Nervous and Mental Disease* (198:6), pp 444-449.

Teo, A., Stufflebam, K., and Kato, T. 2014. "The intersection of culture and solitude: The hikikomori phenomenon in Japan," in *The handbook of solitude: Psychological perspectives on social isolation, social withdrawal, and being alone,* R. Coplan and J. Bowker (eds.), Wiley-Blackwell: UK, pp. 445-460.

Thompson, M., Nordin, I., and Cairns, P. 2012. "Effect of touch-screen size on game immersion," *Proceedings of the 26th Annual BCS Interaction Specialist Group Conference on People and Computers*.

Tiwana, A. 2015. "Platform desertion by app developers," *Journal of Management Information Systems* (32:4), pp 40-77.

Tiwana, A., and McLean, E. R. 2005. "Expertise integration and creativity in information systems development," *Journal of Management Information Systems* (22:1), pp 13-43.

Tom, E., Aurum, A., and Vidgen, R. 2013. "An exploration of technical debt," *Journal of Systems and Software* (86:6), pp 1498-1516.

Treem, J. W., and Leonardi, P. M. 2013. "Social media use in organizations: Exploring the affordances of visibility, editability, persistence, and association," *Annals of the International Communication Association* (36:1), pp 143-189.

Tripsas, M. 2009. "Technology, identity, and inertia through the lens of "The digital photography company"," *Organization Science* (20:2), pp 441-460.

Turel, O. 2015. "An empirical examination of the "vicious cycle" of Facebook addiction," *Journal of Computer Information Systems* (55:3), pp 83-91.

Turel, O., and Serenko, A. 2010. "Is mobile email addiction overlooked?," *Communications of the ACM* (53:5), pp 41-43.

Turel, O., and Serenko, A. 2012. "The benefits and dangers of enjoyment with social networking websites," *European Journal of Information Systems* (21:5), pp 512-528.

Turel, O., Serenko, A., and Giles, P. 2011. "Integrating technology addiction and use: An empirical investigation of online auction users," *MIS Quarterly* (35:4), pp 1043-1061.

Turner, B. 2020. "The world's greatest psychological experiment': When the loneliness epidemic met the coronavirus pandemic," (available at https://bit.ly/3c5mprL).

Uchida, C. 2010. "Apathetic and Withdrawing Students in Japanese Universities—with Regard to Hikikomori and Student Apathy—," *Journal of Medical and Dental Sciences* (57:1), pp 95-108.

Uchida, Y., and Norasakkunkit, V. 2015. "The NEET and Hikikomori spectrum: assessing the risks and consequences of becoming culturally marginalized," *Frontiers in Psychology* (6), p 1117.

Vallaster, C., and von Wallpach, S. 2013. "An online discursive inquiry into the social dynamics of multi-stakeholder brand meaning co-creation," *Journal of Business Research* (66:9), pp 1505-1515.

Van Maanen, J. 1979. "The fact of fiction in organizational ethnography," *Administrative Science Quarterly* (24:4), pp 539-550.

von Hippel, E. 1986. "Lead users: A source of novel product concepts," *Management Science* (32:7), pp 791-805.

Vorderer, P., Hartmann, T., and Klimmt, C. 2003. "Explaining the enjoyment of playing video games: the role of competition," *Proceedings of the Second International Conference on Entertainment Computing*.

Wagner, E., Newell, S., and Piccoli, G. 2010. "Understanding project survival in an ES environment: A sociomaterial practice perspective," *Journal of the Association for Information Systems* (11:5), pp 276-297.

Walsham, G. 1995. "Interpretive case studies in IS research: Nature and method," *European Journal of Information Systems* (4:2), pp 74-81.

Walsham, G. 2006. "Doing interpretive research," *European Journal of Information Systems* (15:3), pp 320-330.

Wang, P. 2021. "Connecting the parts with the whole: Toward an information ecology theory of digital innovation ecosystems," *MIS Quarterly* (45:1), pp 397-422.

Wasko, M., Teigland, R., Leidner, D., and Jarvenpaa, S. 2011. "Stepping into the Internet: New ventures in virtual worlds," *MIS Quarterly* (35:3), pp 645-652.

Wei, P. S., and Lu, H. P. 2014. "Why do people play mobile social games? An examination of network externalities and of uses and gratifications," *Internet Research* (24:3), pp 313-331.

Weick, K. E. 2012. *Making sense of the organization, Volume 2: The impermanent organization*, John Wiley & Sons.

Wijman, T. 2018. "Mobile Revenues Account for More Than 50% of the Global Games Market as It Reaches $137.9 Billion in 2018," (available at https://bit.ly/2vTPrbR).

Williams, K. D., Cheung, C. K., and Choi, W. 2000. "Cyberostracism: effects of being ignored over the Internet," *Journal of Personality and Social Psychology* (79:5), pp 748-762.

Wong, J., Wan, M., Kroneman, L., Kato, T., Lo, T., Wong, P., and Chan, G. 2019. "Hikikomori Phenomenon in East Asia: Regional Perspectives, Challenges, and Opportunities for Social Health Agencies," *Frontiers in Psychiatry* (10:512), pp 1-7.

Wong, P., Li, T., Chan, M., Law, Y., Chau, M., Cheng, C., Fu, K., Bacon-Shone, J., and Yip, P. 2015. "The prevalence and correlates of severe social withdrawal (hikikomori) in Hong Kong: a cross-sectional telephone-based survey study," *International Journal of Social Psychiatry* (61:4), pp 330-342.

Wong, P., Liu, L., Li, T., Kato, T., and Teo, A. 2017. "Does hikikomori (severe social withdrawal) exist among young people in urban areas of China?," *Asian Journal of Psychiatry* (30:34), pp 175-176.

Wood, R. T. A., Griffiths, M. D., Chappell, D., and Davies, M. 2004. "The Structural Characteristics of Video Games: A Psychostructural Analysis," *CyberPsychology & Behavior* (7:1), pp 1-10.

Woodard, C. J., Ramasubbu, N., Tschang, F. T., and Sambamurthy, V. 2013. "Design capital and design moves: The logic of digital business strategy," *MIS Quarterly* (37:2), pp 537-564.

Wright, K. B., and Bell, S. B. 2003. "Health-related support groups on the Internet: Linking empirical findings to social support and computer-mediated communication theory," *Journal of Health Psychology* (8:1), pp 39-54.

Wu, M.-Y., and Pearce, P. L. 2014. "Appraising netnography: Towards insights about new markets in the digital tourist era," *Current Issues in Tourism* (17:5), pp 463-474.

Xu, Z., Turel, O., and Yuan, Y. 2012. "Online game addiction among adolescents: motivation and prevention factors," *European Journal of Information Systems* (21:3), pp 321-340.

Xue, Y., Liang, H., Boulton, W. R., and Snyder, C. A. 2005. "ERP implementation failures in China: Case studies with implications for ERP vendors," *International Journal of Production Economics* (97:3), pp 279-295.

Yee, N. 2006. "Motivations for playing online games," *Cyberpsychology & Behavior* (9:6), pp 772-775.

Yoo, Y., Henfridsson, O., and Lyytinen, K. 2010a. "Research commentary—the new organizing logic of digital innovation: An agenda for information systems research," *Information Systems Research* (21:4), pp 724-735.

Yoo, Y., Lyytinen, K., Thummadi, V., and Weiss, A. 2010b. "Unbounded innovation with digitalization: A case of digital camera," *Annual Meeting of Academy of Management*.

Young, K. 2010. "Internet addiction over the decade: a personal look back," *World Psychiatry* (9:2), pp 91-91.

APPENDIX A: SAMPLE CODING TABLE FOR EMPIRES & PUZZLES CASE STUDY

First-Order Concepts	Second-Order Themes	Aggregate Dimensions
Randomness of outcome *"Know that you won't get what you want. Occasionally you will. But unless you're going to be a 'whale' (a gamer who spend an inordinate amount of money on the game), there's never enough to guarantee you can just buy your desired outcome."* **Gacha** *"Gacha can be played responsibility (sic), but it is also a system that is designed to entrap players. It is, after all, Gambling. Gacha is designed to pull from expendable incomes (especially from those with huge incomes) but it is designed to exploit."*	**Chance-taking**	**Intermittent Reinforcement**
Expression of excitement *"Merlin is my first 4 starred purple hero. Wow, what a hero. I am having so much fun with him. Watching enemies shooting themselves because of his special skill is entertaining and satisfying. Merlin is absolutely awesome."* **Thrill of winning** *"I bought 2600 gems and got trash 3 starred heroes. But at the end a picture appeared and showed that I received the hero of the month. I screenshotted it and showed to my friends."*	**Arousal / Euphoria**	
Regular game updates *"The update has been forced for Android and iOS now. We have been busy working on overhauling our existing Challenge Events. We are happy to announce that the updated Challenge Events are now approaching!"* **Availability of new in-game resources** *"While I already have enough 5 starred heroes to ascend next year, I want a nice, red, five starred hero in the next update."*	**Incremental Content Release**	**Interest Rejuvenation**
Anticipation of new heroes *"Monthly heroes via special quests would keep the game interesting for long-time players while also giving F2P players an incentive to stick around (and get tempted into buying one of your cheaper, high-value deals for gems). Each month, you just offer an exclusive new quest area, at the completion of which players would be guaranteed the hero of the month (or one of the heroes of the month)."* **Interest in to-be-released content** *"Does anyone have a picture of Gregorian scarred (in-game hero). I would just like to see his numbers so I can be utterly disappointed when I don't get him next month."*	**Curiosity Stimulation**	

APPENDIX B: METHODOLOGICAL DETAILS FOR FINTECH PLATFORM COMPANY CASE STUDY

B.1 Details of Primary Interviews

Code and Title	Topics Discussed
Table 11: Details of Primary Interviews for Fintech Platform Company Case Study	
D1: Managing Director	History of FPC, a process of digital debt accrual, project implementation journey, system development journey, a process of architectural transformation, how key decisions on projects were made, interactions with client companies, clients demand fulfilment process
S1: Senior Manager A (Strategy & Planning)	A process of digital debt accrual, project implementation journey, systems development journey, how key decisions on projects were made, clients demand fulfilment process, how decisions were communicated to client companies, interactions with client companies, a process of architectural transformation
S2: Senior Manager B (Strategy & Planning)	Drivers and inhibitors of next generation system development, overview of systems configuration, integration, and maintenance, interactions between FPC and client companies, how key decision on projects were made and communicated, a process of digital debt accrual
S3: Senior Manager C (Strategy & Planning)	How the S&P department communicated with client companies and responded to project decisions, drivers and inhibitors of system development, overview of system configuration, integration, and maintenance, how key decision on projects were made and communicated, a process of digital debt accrual
S4: Senior Manager D (Strategy & Planning)	Drivers and inhibitors of system development, how the S&P department communicated with client companies, how key decisions on projects were made, overview of clients demand fulfilment process
M1: Manager (Strategy & Planning)	How key decisions on projects were made, how the strategies and plans were implemented, how the quality of system development was assured, organizational role of S&P department
M2: Manager (Research & Development)	Overview of system configuration, integration, and maintenance process, major challenges faced during system development, how the R&D department communicated with other business units and responded to project decisions
A1: Associate (Strategy & Planning)	Major challenges faced during system development, major challenges faced during architectural transformation, how the S&P department communicated with other business units and responded to project decisions, a process of architectural transformation, how client companies responded to using next generation systems
A2: Associate (Business Administration)	How project requests were proposed by client companies, how client companies responded to using next generation systems, major challenges faced during the legacy system operation, major challenges faced during switching users from a legacy to new system, a process of architectural transformation
A3: Associate (Research & Development)	How project requests were proposed by client companies, how the R&D department responded to project decisions, how the R&D department communicated with client companies
A4: Analyst (Research & Development)	How the R&D department supported the overall project implementation, digital tools used for effective communication with client companies, how the S&P department communicated with other business units and responded to project decisions

B.2 Sample Interview Questions for Managing Director of FPC

Thematic Interview Guide for Interview with Managing Director of FPC

A Process of Digital Debt Accrual
- Based on your experiences and your interpretation of what digital debt is, what do you think constitutes digital debt?
- Based on your experiences and your interpretation of what digital debt is, when and how do you think digital debt arises?
- What do you think are the causes of digital debt?
- What do you think are the benefits and drawbacks of allowing digital debt to accrue?

Project Implementation
- Could you describe the common characteristics of client companies?
- When and why do client companies usually initiate contact with FPC?
- What are the benefits and drawbacks of outsourcing system development?
- Could you walk us through the project implementation journey?
- How did you ensure the effectiveness of communication between different business units?

System Development
- What do you think are the factors precipitating new system development?
- Were there requirements from your clients that were a concern for you? If so, how did your company and client companies respond?
- Were there any limitations in your client companies? If so, how did your company respond to overcome them?

A Process of Architectural Transformation
- Could you describe a typical architectural transformation process?
- How do you ensure system reliability?

How were Key Decisions Made?
- How were the key decisions on system development made?
- What information was considered in the making of those decisions?
- How were the decisions communicated to the relevant stakeholders?

B.3 Sample Coding Table for the Stages of Digital Debt Accrual

Table 12: Preliminary Coding Table for the Stages of Digital Debt Accrual	
Dimensions and Second-Order Themes	**First-Order Concepts** and Case Evidence [Source]
Stages of Digital Debt Accrual	
A. Coerced Outsourcing	**A. Forced to Outsource due to Lack of Internal Capabilities** *"Clients are forced to outsource their systems development when they have no (or lack of) experience or have insufficient developers and human resources."* [A4: Analyst of R&D Department]
B. Design Economization	**B. Compromise on System Design** *"If the plans on RFP could not be fully completed due to inevitable limitations, the instable system operation may arise as the future problem. In order to resolve this problem, additional manpower will be required, and this will bring monetary loss to companies."* [A3: Associate of R&D Department]
C. Piecemeal Development	**C. Fragmented System Development** *"When client companies have tight business schedule (and budget), they launch certain (e.g., minimum core) features first in the market without aligning these features with the overall system design. This action generates future system modification tasks. These future obligations extend workload."* [S3: Senior Manager C of S&P Department]
D. Redundant Concurrency	**D. Dual Operation of Old and New Systems** *"When existing consumers refuse to transition to a modern system, companies are forced to maintain the legacy system. Although the transition from the legacy to the next generation system is difficult, companies never give up the next generation system."* [A2: Associate of Business Administration Department]

APPENDIX C: METHODOLOGICAL DETAILS FOR YOKAYOKA HIKIKOMORI SUPPORT CENTER CASE STUDY

C.1 Details of Primary Interviews

Table 13: Details of Primary Interviews for Yokayoka Hikikomori Support Center Case Study	
Code and Title	**Topics Discussed**
Center Management	
M1: Head of Yokayoka Hikikomori Support Center (YHSC)	History of YHSC, history of Hikikomori development, how key decisions on sessions and activities for Hikikomori were made, digital treatment interventions for Hikikomori, major objectives and outcomes of programs ran by the center, how Hikikomori interacted with IT, outcomes of Hikikomori after using IT, process of job training for Hikikomori
M2: Head of Hikari Lab and Sparx	*Profile: Hikari Lab is an online counselling firm in Tokyo, that introduced Sparx, a role-playing video game developed based on a computerized cognitive behavioral therapy to recover Hikikomori.*
	Hikikomori development journey, how Hikikomori were influenced by IT, types of IT that Hikikomori used, major objectives and outcomes of Sparx and digital interventions, how Hikikomori interacted with technology and Sparx
M3: Head of Shinjuku Support Station	*Profile: Shinjuku support station provides services of lifestyle training and job training to Hikikomori.*
	History of Shinjuku support station in Tokyo, process of digital intervention programs for Hikikomori at Shinjuku support station, major objectives and outcomes of programs ran by the station, how Hikikomori interacted with IT, outcomes of using IT, process of job training for Hikikomori
M4: Head of the home e-learning department of Sarana E-learning	*Profile: Sarana E-learning is a company that is specialized in creating home e-learning software for children. They create teaching materials for home schooling for their own software and also distribute those materials to after-schools.*
	How Hikikomori interacted with and reacted to virtual fictional characters, difference between Hikikomori children and typical children of home learning, materials and programs offered by home learning, Hikikomori's preference of learning
M5: Owner of Favery Video Game Company	*Profile: Favery, established in 2014, is a women's novel video game company that creates virtual fictional characters and novel story illustration for video games, users are often females and they become a protagonist of a novel story and interact with other virtual fictional characters, users often fall in love with an attractive male character in the game, characters are manga illustration.*
	The collaborative work between YHSC and Favery, treatment interventions they provided for Hikikomori, interaction between users of

	Favery video game and virtual fictional characters, relationship between users of the game and virtual fictional characters
M6: Owner of Impact Hub Trip Center	*Profile: Impact hub trip, established in 2015, is a center that offers online services to people suffering from depression and supports their families by providing recovery solutions*
	History of Impact hub trip, process of digital intervention programs for Hikikomori and their family members, major objectives and outcomes of programs ran by the center, how Hikikomori and their family members interacted with IT
M7: Volunteer Manager of YHSC	Trajectory of Hikikomori experience, his volunteering work experience at YHSC, trajectory of Hikikomori treatment process, outcomes of programs ran by the station
Software Developers	
S1: E-learning software developer of Sarana E-learning	*Profile: Have been working for 1 year and a half, work with parents of children who have developmental disability, develop e-learning services for children with attention deficit hyperactivity disorder (ADHD), train those children to learn English speaking*
	How Hikikomori interacted with and reacted to virtual fictional characters, relationship between software features and Hikikomori treatment, home e-learning trajectories
Clinical Psychologists	
C1: Clinical Psychologist A of YHSC	*Profile: Have been working for 4 years, conduct psychological test for Hikikomori (e.g., data analysis, statistics), meet one Hikikomori every two weeks*
	Process of psychological test for Hikikomori, Hikikomori development journey, interaction between Hikikomori and technology, what kinds of IT that Hikikomori used, how Hikikomori engaged in IT, digital treatment interventions
C2: Clinical Psychologist B of YHSC	*Profile: Working on Hikikomori, Internet addiction, gambling addiction, drug addiction, and alcoholic addiction, give telephone consulting*
	The process of counseling sessions with Hikikomori, characteristics and symptoms of Hikikomori, Hikikomori development journey, the interaction between Hikikomori and technology, digital treatment interventions
C3: Clinical Psychologist C of Bowl company	*Profile: Bowl company is specialized in treating people with depression and training them to go back to their work, work with Sparx collaboratively*
	Process of assessing the conditions of Hikikomori, Hikikomori development journey, digital interventions in collaboration with Sparx
Psychiatrists	
P1: Psychiatrist A	Drivers influencing Hikikomori development, Hikikomori development journey, how Hikikomori were influenced by IT, types of IT that Hikikomori used, how Hikikomori interacted with technology, outcomes of IT use on Hikikomori
P2: Psychiatrist B	Detection of Hikikomori, treatment interventions, available support for Hikikomori, external drivers influenced Hikikomori development, influence of technology on the behavior of Hikikomori
P3: Psychiatrist C	Diagnosis of Hikikomori, physical deterioration of Hikikomori, Hikikomori development journey, interaction between Hikikomori and

	technology, what kinds of IT that Hikikomori used, how Hikikomori engaged in IT, digital treatment interventions
Parents of Hikikomori	
PH1: Mother of a Hikikomori Son	How a mother first found out her son's situation, daily routine of her son, emotions of her son, supports she gave him to overcome the situation, son's interaction with technology, available support from YHSC
Hikikomori	
H1: Hikikomori A	*Profile: Male, 38 years old, has been Hikikomori for 20 years since he was 18 years old, truancy during all high school period, have not been able to go out for 20 years since graduated a senior high school*
	Reasons of not going out and changing his socialization patterns, programs and activities that he enjoyed the most at YHSC, his view on the use of IT, his interaction with technology
H2: Hikikomori B	*Profile: Male, 26 years old, diagnosed as depression by a doctor while enrolled as a university student at 20 years old in Tokyo, moved to Fukuoka at 26 years old and diagnosed as a bipolar disorder by another doctor*
	Experience on his mental issues, changes of his environment (e.g., moved from Tokyo to Fukuoka), changes of his socialization patterns, his interaction with technology
H3: Hikikomori C	*Profile: Male, stayed only at home for 6 months, moved from Tokyo to Fukuoka a year before becoming Hikikomori, wanted to be a medical doctor while he was studying at university.*
	Changes of his socialization patterns, changes of his environment (e.g., lived with family and lived alone), his interaction with technology
H4: Ex-Hikikomori D	Trajectory of Hikikomori experience, his volunteering work experience at YHSC, how IT helped him finding YHSC for treatment of the disorder

C.2 Sample Interview Questions for Clinical Psychologist of YHSC

Thematic Interview Guide for Interview with Clinical Psychologist of YHSC

Drivers influencing Hikikomori development
- What are the major drivers influencing Hikikomori development?
- What external factors affect Hikikomori development?
- What internal factors affect Hikikomori development?
- How are Hikikomoris influenced by technology?

The Nature and Process of Hikikomori development
- When is a person first recognized as a Hikikomori?
- What are the major characteristics and symptoms of Hikikomori?
- What are the major stages of Hikikomori development?
- Can you describe the Hikikomori development journey?
- How do Hikikomori symptoms evolve over time?

The Use of IT
- What kinds of technology do Hikikomoris typically use?
- How do Hikikomoris interact with technology?
- Why do Hikikomoris use IT persistently?
- Are there more Hikikomoris because of IT use?
- Is Hikikomori exacerbated because of the use of IT?
- Do Hikikomoris have higher tendency to technology addiction than others?

Digital Treatments/Interventions
- What is the support center's role in terms of the digital aspects of Hikikomori?
- How is your digital intervention program different from other interventions?
- Can you describe the process of digital treatment programs?
- How do Hikikomoris participate in your digital treatment program?
- What are the major objectives and outcomes of your digital interventions?
- How would you evaluate the effectiveness of your digital treatment program in terms of the improvement and alleviation of Hikikomori symptoms?

Hikikomori Counseling Objectives, Processes and Outcomes
- What is the support center's role in terms of the socialization aspects of Hikikomori?
- Can you describe the process of a counseling session?
- What topics are discussed during a counseling session?
- What are the major objectives and outcomes of these sessions?
- How would you evaluate the effectiveness of your counselling sessions in terms of the improvement and alleviation of Hikikomori symptoms?

C.3 Sample Coding Table for Pathological Hikikomori

Dimensions and Second-Order Themes	First-Order Concepts and Case Evidence [Source]
Table 14: Preliminary Coding Table for Stage 3 Pathological Hikikomori	
1. Stage A. Pathological Hikikomori	**a) Fear of social rejection and social anxiety** *A1. "Many Hikikomori have difficulties in communicating with other people. From the personality test perspective, we call it a developmental disorder or an autism spectrum disorder (that affects communication, social skills and behavior)." [C1: Clinical Psychologist A of YHSC]*
2. IT Escape B. Spiritual Escape	**a) Social presence** *B1. "My son played online games all day for 10 years since he was 16 years old. By playing games, he wanted to forget everything and his school life. Playing game was very important to him so he was always playing games." [PH1: Mother of a Hikikomori Son]* **b) Virtual existence** *B2. "A user builds an attractive character by herself. Based on the characteristics of the virtual fictional character that the user made, medical experts or mental health professionals provide consultation on the conditions of the Hikikomori. Users build relationships with their character and even fall in love with the character." [M5: Owner of Favery video game company]* **c) Time and cost commitments** *B3. "Hikikomori physically isolate themselves. They withdraw from going out and participating in social situations (e.g., go to work and school). They don't directly contact with friends and only limit social contact to the family members and the people they live with. They have very limited or nearly no friends." [P1: Psychiatrist A]*
3. Physical Social Outcomes C. Complete Physical Isolation	**a) Fear of social situations** *C1. "My son could not go outside. He was afraid of going outside and encountering social situations." [PH1: Mother of a Hikikomori Son]* **b) Disconnectedness from the physical world** *C2. "Hikikomori prefer not to talk to their family members. This may lead to bad relationship with the family members. But they still stay at home. ... Hikikomori don't go out, don't have friends, and avoid social contact. In most cases, their family members worry about their situations, but Hikikomori choose to remain alone in their rooms." [P2: Psychiatrist B]*