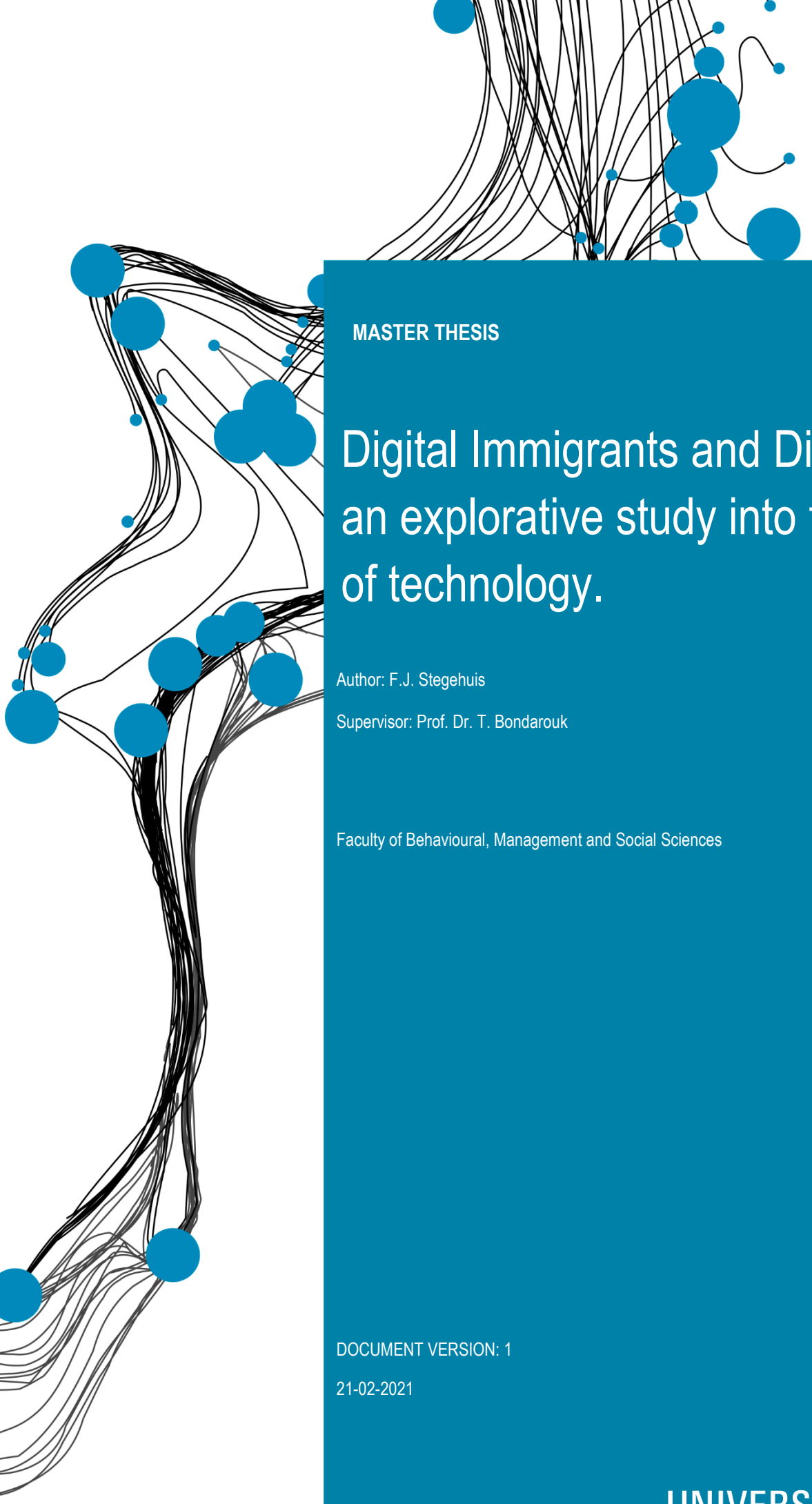

MASTER THESIS

Digital Immigrants and Digital Natives: an explorative study into the adaptivity of technology.

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ABSTRACT

Recent studies depicted that the "workplace of the future" will become heavily dependent on Information Technology (IT) and the digital tools that it provides to organizational workers. However, multiple studies have shown that these digital tools have disruptive effects on its end-users, which scholars depicted as so-called *Agency-conflicts* between the end-user and the technological artifact. Furthermore, these end-users also differ individually which some scholars depicted as a difference in generation. They argued that generations of workers called *Digital Immigrants* were assumed to face more difficulty while working with digital tools when compared to the so-called *Digital Native* generations. Thus, for businesses to cope with the increased dependency on IT and the disruptive effects that it may have on their workforce, which often consists of multiple generations of workers, the interactions between digital tools and their end-users needed a closer look. We reviewed and combined two streams of literature, namely Agency-theory and digital generations & IT, and noticed that both of these literary streams depicted technology as rigid and that change only occurred because of the end-user's efforts. We therefore aimed to explore the possibilities for technology to adapt to its end-users, that we conceptualized as the adaptiveness of technology or *Technological Adaptivity*, which we claimed could reduce the disruptive effects of digital tools on the differing digital generations of end-users.

We conducted a series of interviews with *Digital Immigrants, Digital Natives* and the designers of digital tools, and found that the presumed digi-generational differences among the two groups of end-users were not apparent because they both either *learned* how to work with digital tools or had *affluence* toward them. Moreover, it appeared that differences in IT-usage can be better explained by the differing goals of individuals rather than their age and thus generation. Furthermore, we specified three characteristics of *Technological Adaptivity*, namely: *End-user Input, User Experience* and an *Adaptive Trend* as well as restrictive factors on *Technological Adaptivity* in terms of *Interpersonal differences, Technological Boundaries* and O*rganizational Restrictions*. Whereas the *End-user Input* confirmed that the end-user's effort caused digital tools to change, the importance of *User Experience* and the *Adaptive Trend* within IT-design were actually causing digital tools to change *independently* of the end-user's effort. Hence, digital tools were not as rigid as both literary streams assumed them to be. Furthermore, the fact that digital tools were adapting *independently* of their end-users was unaccounted for in the literary streams on agency-theory. Therefore, we question if the depicted disruptive nature of IT is going to be problematic within the "Workplace of the Future" because digital tools are expected to become increasingly adapted towards it end-users. Furthermore, we also add to the scholarly debate on digital generations & IT by uncovering that *Learning & Affluence* diminishes differences across generations in terms of technology-usage and competency.

INTRODUCTION

Information Technology (IT) is all around us in our work-environment. Over the past few decades, businesses have applied IT in their organizational processes in an increasing fashion. It is hard to imagine a job without the usage of any related "digital tool" provided by IT. These tools can for instance be a database, ERP-system, E-mail or a videocall-application like Skype or Microsoft teams. This trend of rapid technological change within organizations is not going to stop. On the contrary, it is going in a new direction. Both the key player Microsoft and "Big Four" accounting firm Deloitte describe the "Workplace of the Future" to be one that consists of working independently of time and place through the interconnectivity of IT-systems and applications. (Job Wizards, 2020; Grammp & Zobrist, 2018).

According to the recent IT-literature, IT has always been known for causing a rapid speed of change within businesses (Wang, Wang, Zang & Ma, 2020; Dittes, Richter, Richter & Smolnik 2019; Cheng, Bao & Zarifis 2020; Kaplan en Heinlein 2019; Oberlander, Beinicke & Bipp 2020; Davison, Ou & Ng 2019). But apart from the latter, IT has institutionalized and is becoming an integral part of businesses. In this way, it is continuously altering the way employees do their work as new digital tools will continue to emerge. The interconnectivity, being able to work regardless of place and time, is a new concept that reflects how IT is transforming businesses into a new era of work (Wang, Wang, Zang & Ma, 2020; Dittes, Richter, Richter & Smolnik 2019; Cheng, Bao & Zarifis 2020; Kaplan en Heinlein 2019; Oberlander, Beinicke & Bipp 2020; Davison, Ou & Ng 2019). Moreover, Kaplan and Heinlein (2019) stated that the digital transformation caused by IT becomes an 'issue that every company has to deal with' (p. 680), stating that "40% of businesses will die in the next decade if they are unable to transform themselves in the light of new technologies' (p. 679). Thus, it is important for modern day business to cope with the increasing importance of IT, not only for their organizations as a whole but more specifically for their employees as

they will become more dependent on the digital tools when working in the "workplace of the future".

The employees of an organization are the users of digital tools and therefore also the subject of the disruptive nature of the technology, both in a positive and negative way. Scholars provide several examples, stemming from empirical and conceptual studies, of the disruptive effects of the technology. Firstly, Wang et al. (2020) found that the usage of IT-systems has a significant influence on the job-satisfaction of employees, but that only a mere 9% of practitioners embrace improving the IT-user's experience. Secondly, Cheng et al. (2020) argued that while IT can bring convenience to employees, it also has negative influence through the frequent interruptions it can cause in one's workday. Their study has shown the link between interruptions caused by IT and emotional exhaustion, which is a common precedent for job related burnout. Moreover, another study highlighted the overflow of information and hence complexity that IT causes in the workplace. While the new digital resources allow an employee to manage his or her tasks regardless of space and time, the overflow of options causes the individual to flee to 'original routines of working' instead of using new IT-applications, while also experiencing an increase in work-related stress (Dittes et al., 2019). Lastly, Davison et al. (2019) argue that there is a general consensus that both the absence of technical skills and inadequate on-the-job training contribute to problems among employees who need to use a variety of IT-applications. Their motivation, enthusiasm and performance can all suffer, which is harmful to the organization as a whole. While training and work-achievement could improve the latter, it is often found that there is no sufficient repetition of on-the job training.

The examples of recent empirical studies mentioned above show that one may expect evolved routinization of IT-user interlacement. However, the reality is that the users are affected and disrupted by the digital tools that IT provides in their every-day job. It looks like historical developments do not demolish the disruptive effect of IT on users. These affections are conceptualized by some scholars in terms "*Agency-conflicts*" between the user and the technology.

The agency theory, as applied to the IT usage, elaborates on how users enact with technology. They apply their "agency", in other words goals and needs, onto a technological artifact. In this sense, they want to explain the technology and use it in order to achieve their goals and needs (Boudrau & Robey, 2005; Leonardi, 2013). Apart from users, the technology itself also has the ability to independently 'constrain human agency once they are installed and left to operate' (Boudrau & Robey, 2005, p. 4) through the limited set of options that it provides. Thus, both user and technological artifact enact with each other, often leading to consequences like the ones described in the previous paragraph. However, these consequences are unpredictable due to the fact that IT-usage and IT-affection differs among individuals (Wang et al., 2020; Davison et al., 2019; Cheng et al., 2020; Dittes et al., 2019; Kesharwani, 2020; Leonardi, 2010; Boudrau & Robey, 2005).

The differences among users of digital tools are depicted by some scholars through the division of a workforce into *Digital Natives* and *Digital Immigrants* (Dittes et al., 2019; Eginli & Isik, 2020; Kesharwani, 2020). *Digital Natives* and *Digital Immigrants* are linked to the different generations of people that live and work in today's society. According to Kesharwani (2020) and Enginli and Isik (2020), a *Digital Native* is born after the 1980's, and therefore exposed to digital technologies at a very early stage of his or her live. In contradiction, *Digital Immigrants* are born before the 1980's and thus before the rising importance of digital technologies at the workplace. Dittes et al. (2019) add that *Digital Natives* extensively use digital technologies in their daily life and thus expect the same technologies at their work. In contradiction, *Digital Immigrants* are not used to the new technologies and therefore very reluctant and critical towards them. The latter results in certain differences like a more active involvement level regarding digital tools by *Digital Natives*, that use them both in their professional and private lives whereas *Digital Immigrants* solely use them in their professional lives. Moreover, *Digital Natives* also seem to communicate differently with IT-tools, by means of instant messages and online chats, whereas *Digital Immigrants* stick to the more traditional forms of online communications like e-mailing or calls. Lastly, it was assumed that *Digital Natives* use digital tools for networking activities whereas *Digital Immigrants* use it solely to increase their functionality (Kesharwani, 2020).

The latter indicates that the age- and thus generation of an end-user has an effect on IT-usage and affection. However, the work of Kersharwani (2020) and Dittes et al. (2019) is questioned by Eginli & Isik (2020) and Waycott et al. (2010) who argue that a number of synergies exist among generations. As a matter of fact, the work of Parry (2017) questions if generational differences should be based on age of an individual and suggests that more factors need to be included in order to uncover were true generational differences lie. Hence, differences could also lie within generations,

rather than solely across them when they are divided by the age of individuals.

Whether we agree with the age-related IT attributions that are described by the scholars and the debate on whether differences even exist among generations, we did find that researchers do see differences in working with digital tools that are related to the user age. Hence, different digital generations of end-users are assumingly affected by- and using IT in different ways, and this element of end-user generation is not accounted for in the literature on agency theory. More importantly, if one considers the fact that generations of humans will always follow each other up together with the rapid and evolving development of IT within businesses, its is fair to assume that the *Digital Natives* of today could actually become the *Digital Immigrants* of tomorrow. Thus, the role of the end-user generations and their relationship with digital tools needs a closer look if businesses want to avoid repetitive issues that emerge from the human-IT relationship and cope accordingly with the current trend of IT.

However, the scholarly debate into digital generations and IT view technology to be unchangeable and rigid. For instance, Desouza, Awazu and Ramaprasad (2007) state that "The IT literature has mostly treated users as passive consumers of technology" (p. 205), implying that the user simply uses the technology based on its design and depicting the technology as a rigid artifact. But as described earlier in terms of *Agency-conflicts*, users do get affected by technology, making them active instead of passive. Furthermore, Penteado et al., (2019) also mention that "if we approach technological artifacts in a linear fashion, they are considered to be predictable and unchanging" (p. 4). Therefore, the user is seen as the one who needs to adapt to the technological artifact, considering that this artifact cannot change toward the user. In fact, research has already been conducted to uncover users' competencies that are essential to adapt to- and work with IT (Fleaca & Stanciu, 2019; Oberlander et al., 2020; Siddoo, Sawattawee, Janchai & Thinnukool, 2019).

However, we argue that human generations will follow each other up while IT itself is continuously evolving independently of its users. It is therefore questionable as to why the scholarly literature is "frozen" and keeps advising towards users who need to adapt, adopt, learn, accept, and/or adjust to a new digital tool. We argue that it is time to explore possibilities for digital tools to adapt to users. Therefore, the goal of this study is to explore the possibilities of IT becoming the adaptive agent in the Human-IT interactions that occur at the workplace.

To find out what the possibilities are for this proposed *Technological Adaptivity*, a central research question was formulated, stating:

"*What are characteristics of technological adaptivity towards different user-generations in modern-day organizations"?*

To address this question, the theory of agency will be reviewed together with the literature on digital generations and IT to generate a set of starting insights. The theory of agency provides a deep understanding on the specific interaction between users and technology. However, agency theory does not cover the phenomenon of digital human generations. In this sense, the literature on digital generations and IT will be added to provide this contextual knowledge. The literature review allows to create guidelines for a series of interviews with both users and designers of IT. The insights from both the users and designers of digital tools, together with the theoretical knowledge on the relationship between the two, will be used to identify characteristics of *technological adaptivity* towards different user-generations if there are indeed differences between the two.

In doing so, the results of this thesis will provide a novel view to the agency-theory. We detach from the original views on solely user-adaptivity and provide a basis for a new theory to emerge about the human-IT relationship focusing on *Technological Adaptivity*. Adding to this, we add to the scholarly debate regarding digital generations and IT by exploring whether differences do exist among them. Furthermore, the literature on digital generations and IT has mostly been empirically tested within an educational setting. This research will extend that by including business-environments. Moreover, practitioners can use the implications from this thesis to improve the job-satisfaction and productivity of their employees, because after all their employees are the end-users of IT. More importantly, they will be able to cope better with the increasingly important and shaping role of IT in their organizations. A more adaptive stream of IT-technology will avoid extensive training and the costs that are tied to it while also supporting employees that become more dependent on it.

The thesis is structured as follows. First, the literature streams of agency and digital generations & IT will be reviewed. Second, the data-collection consisting of interviews and the analysis of the data be described in the methodology section. Third, the results of the interviews will be discussed. Lastly, the thesis will end with a discussion, conclusion, and possible avenues for future research.

PERSPECTIVES OF AGENCY WITH A GENERATIONAL TOUCH

Agency can be viewed from either the end-user perspective or from the perspective of the technology itself. While Agency theory covers both perspectives, the literature on digital generations and IT provides deeper insights on the end-user perspective as well. In this thesis, we view "Technology" in terms of digital tools in a work environment. Hence, articles are selected based on a query that ensures only studies that cover technology in terms of digital tools in a work-environment are included.

HUMAN AGENCY: THE END-USER PERSPECTIVE

As described earlier, the theory of agency elaborates on the enactment between end-users and technological artifacts (Anaya, 2020; Boudrau & Robey, 2005; de Boer & Slatman, 2018; Cousins & Robey, 2005; Hultin, 2020; Leonardi, 2013, 2011, 2010, Orlowski, 1992). Both the end-user and the technological artifact (hereafter: Digital tool) have a different perspective when it comes to their relationship. We start off with the end-user perspective. Boudrau and Robey (2005) provide a good starting point, stating that 'humans are free to enact with technology in different ways' (p. 3). Cousins and Robey (2005) depict these different ways of enactment with technology further. The authors argue that end-users may enact technological appliances as designers intended or they may improvise with technology to produce unintended patterns of use. Hence, end-users use digital tools in differing and often unintended ways. Leonardi (2013) and Orlowski (1992) explain these differing ways of usage by taking the end-user's specific goals and needs into account when he or she is interacting with a digital tool. The latter has caused the concept of "*Human agency"* to emerge among scholars (Anaya, 2020; Boudrau & Robey, 2005; Cousins & Robey, 2005; De Boer & Slatman, 2018; Leonardi, 2013, 2011, 2010, Orlikowski, 1992).

In this paper, *Human Agency* is seen as the ability of a human being to set and realize goals. However, it is not something that is owned by a specific actor. Rather, it is the appliance of ones' goals or needs to a specific object or phenomenon by an actor (De Boer & Slatman, 2018; Leonardi, 2013, 2011, Orlowski, 1992). As described by Leonardi (2013), people 'Attribute their agency to equipment, machines, formulae and other various apparatus to explain the machinations of the universe through the imposition of causality (p. 62). Thus, in case of interactions with IT, *Human Agency* consists of how humans enact with technology to explain it and how they use it to achieve their goals and needs. An appliance of *agency* must therefore be seen as the "options of action" that an end-user theorizes about when using technology, thereby also choosing if they appreciate it or not (De Boer & Slatman, 2018; Orlikowski, 1992). When end-users apply their own unique *agency* on technological artifacts, it could lead to them using the artifacts in ways that were not intended by the artifact's designer (Cousins & Robey, 2005; De Boer en Slatman, 2018; Orlowski, 1992).

These unintended ways of usage result in a variety of effects depicted in a number of empirical studies that capture agency and technology usage within organizations. For example, Boudrau & Robey (2005) write that human interaction with technology results in two concepts, that of *inertia* and *reinvention*. Basically, *inertia* describes humans avoiding the use of technology for various reasons like the novelty of it and how it isn't their 'used way of doing things'. Furthermore, workers also illustrate *reinvention* in which they do not use technology for its intended purpose, but instead work-around it by using the system in an unusual, sometimes hazardous, manner. Thus, the end-users of the technology applied their *agency* which caused them to either not work with the artifact or work around the artifacts intended purposes. Another example is the case study by Jensen, Kjaergaard and Svejvig (2009) which reports similar results. In their study, several doctors were asked about their interpretations of a new IT-system that was to be implemented. They argued that the system led to unnecessary and time-consuming work tasks that they did not consider as a part of their job, authority, and responsibility. After implementation, they displayed their *agencies* in terms of choosing from different, conflicting logics which they selected given the situation. Thus, the differing goals among the doctoral staff resulted in different usages of the new ERP-system, either modifying it or not using it at all. Hence, the doctors applied their *agencies*, and displayed signs of *inertia* and *reinvention* as described by Boudrau & Robey (2005). Moreover, the empirical work of Leonardi (2011) highlighted how the agencies of multiple crash-test engineers continuously led to the change of work-routines and the functionalities of a digital tool. A new tool was implemented with the purpose of automating the crash-testing process and therefore improving the efficiency of the organization. However, and in synergy with the previously mentioned case-studies, the end-users of the digital tool began applying their *agencies*, using it in a way that was consistent with their own

goals. The engineers perceived the digital tool to be a constraining factor on their "standard routines" and thus used it only for their own specific needs.

Thus, the studies that apply the agency theory show that the specific goals and needs of the user of technology are the key determinant for the various consequences that emerge from the Human-IT relationship. These consequences are often of a damaging nature to an organization because the workers do not "instantly adopt" new technologies and their prescribed functionalities. Rather, the appliance of the user's *agency* on technological artifacts is depicted as to why digital tools are used in an unintended and unanticipated way or not used at all. But as mentioned before, these end-users are all unique individuals who possess different goals and needs. That is why we now turn to the literature on generations and IT that provides more insights on this matter.

DIFFERENT DIGI-GENERATIONS EQUALS DIFFERENT AGENCIES

The differing digital generations are depicted by the literary stream on digital generations and IT as being either *Digital Natives* or *Digital Immigrants* (Dittes et al., 2019; Eginli & Isik, 2020; Kersharwani, 2020; Tilvawala, Myers & Sundaram, 2014; Waycott, Bennett, Kennedy, Dalgarno & Gray, 2010). As mentioned earlier, a *Digital Native* is seen as usually born after the 1980's and has therefore been exposed to novel digital technologies in the early stages of his live. In contradiction, a *Digital Immigrant* is usually born before the 1980's and thus before digital technologies became as disruptive and dominant as they are today. Table 1 provides a quick overview of the main differences between the two groups of technology end-users (Kesharwani, 2020, p. 3). From this table one can already see the difference in technological usage. Whereas *Digital Natives* are active end-users and use the newest forms of technology (online chatting, creating online content), *Digital Immigrants* stick to the more traditional forms of technology usage (e-mail, using content instead of creating it) and show passive involvement. The question remains if *Digital Natives*, based on their early exposure to new technologies, adopt- and work with these new technologies in a quicker fashion than the *Digital Immigrants.*

Table 1:
Key differences between Digital Immigrants and Digital Natives

Basis	Digital Immigrant	Digital Native
Communication	E-mails	Online chats
Mobile Phone	Calls	Instant messages
Information Sharing	Limited and occasional sharing (very important things)	Unlimited and frequent sharing (about daily life happenings)
Blogging	To discuss thoughts with their peers; use as an open discussion forum	To share personal thoughts publicly and use blogging sites as diary.
Usage Behaviour	Single task: users of online content	Multitasking: creator of online content
Involvement level	Passive user; part of professional life	Active users; part of personal as well as professional life
Primary use	To increase functionality	Networking: Interactivity

A study by Kersharwani (2020) has shown that *Digital Natives* and *Digital Immigrants* do differ in terms of post-adoptive technology usage. Based on 'sequential belief updating', which represents the usage of technological artifacts in relation to past experiences and successes, and feedback mechanisms, it appears that *Digital Natives* show more continued usage behaviour than *Digital Immigrants*. As argued by Kersharwani (2020), '*Digital Natives* are already using the technology themselves, while *Digital Immigrants* need a constant reminder to use it and more technology demonstration' (p. 14). Both groups need to be trained differently based on technological skills. The study links the differences to a certain "Digital Inequality", which points to an advantage position for the *Digital Natives* in terms of technological skills and experience. However, we assume that the goals and needs of these *Digital Natives* are more technologically oriented or supplemented than those of *Digital Immigrants*. After all, *Digital Natives* grew up with new technologies and use them more frequently than *Digital Immigrants.* Hence, the

Digital Natives are more comfortable with the new technologies which could *shape* their *agencies* to be more synergized with the digital tool in their work-environment. In contradiction, the *Digital Immigrants* are more old-fashioned, probably causing their *agencies* to be less applicable to or synergized with the new digital tools which leads them to not (optimally) use them. In fact, the easiness of adaption by *Digital Natives* in comparison to *Digital Immigrants* is often mentioned in the digital generations and IT literature (Eginli & Isik, 2020; Kersharwani, 2020; Tilvawala et al., 2014; Waycott et al., 2010).

However, whereas both Kersharwani (2020) and Tilvawala et al (2014) acknowledge a "clear divide" between both groups in terms of adaptivity to new technologies, Eginli & Isik (2020) and Waycott et al. (2010) argue that this division is questionable. Their empirical studies show that a number of synergies exist between *Digital Natives* and *Digital Immigrants*. They argue that a better understanding about the perspectives of both groups is needed to understand the different forms of technology usage and interaction. Parry (2017) adds to the latter, arguing that a difference in generations should not be tied to the age of an individual. Rather, there are more factors that need to be uncovered. While it seems that scholars are arguing about whether *Digital Natives* and *Digital Immigrants* are really separable or not, we assume the different perspectives mentioned by Eginli & Isik (2020) and Waycott et al. (2010) to be differences in *agency* between the groups. Because both groups have experienced technologies differently, they appear to have different technological backgrounds. It is therefore arguable that their *agencies* (read: goals and needs) are *shaped* differently towards technologies at work. As also stated by Tilvawala et al. (2014), 'The differences in *Digital Natives* and *Digital Immigrants* approaches and beliefs about work further add to the complexities' (p. 6). Again, these complexities can be seen as "*Agency-conflicts*", *shaped* by the difference in goals and needs based on the experiences of the end-users in question. Thus, we assume that possible differences between generations are not related to age, but to goals. The latter indicates that differences possibly exist within generations rather than across generations when they divided based on the age of an individual.

Thus, if we view the Human-IT relationship from the perspective of the user, both the agency theory and the theory on digital generations and IT indicate that differences exist between end-users in terms of approaches, perspectives, goals and needs. The appliance of *agency* by the differing end-users because of their differing goals is a good explanation for the different positive and negative effects that emerge from user-IT interaction and can explain the differences between the digi-generations. It also shows that the need for more adaptive technology is justified, because end-users are often keen to work differently with a technology than intended which results in a non-optimized usage or even or non-usage of the digital tool in question. The end-user is dependent of IT in the future, and if technology were to adapt to its end-users the negative effects like dissatisfaction or non-usage would likely decrease or disappear. Therefore, we firstly notice that:

Key insight 1: Digital tools must respond to the human agency to achieve optimal performance and end-user satisfaction.

As far as differences exist between *Digital Natives* and *Digital Immigrants,* both groups have different technological backgrounds that influence their technology usage, which we assume are *shaping* the different *agencies*. We therefore also notice that:

Key insight 2: The different technological backgrounds of digi-generations are possibly shaping the human agencies.

If we take this shaping of agencies due to the different technological backgrounds into account, it is arguable that the next generation of end-users will become more technologically oriented in a way that is synergized with the technology that they grew up with. Just like the *Digital Natives* of today, they will expect more of a digital tool based on their own experiences with technology and the goals that originate from those experiences. A continuous stream of "rigid" technologies that do not adapt to or- meet these varying expectations will continue to cause issues for organizations. We therefore also identify that:

Key insight 3: Rigid and non-adaptive digital tools will continue to cause strong negative disruptive effects for organizations by not meeting their expectations.

These insights also conclude the section about the user perspective in relationship between humans and IT. However, it is also important to view the relationship from the perspective of the technology itself. After all, technology also has the ability to independently 'constrain *human agency* once they are installed and left to operate' (Boudrau & Robey, 2005, p. 4). Thus, the technology itself also has its own influence on the experience and behaviour of its user (Verbeek, 2006).

TECHNOLOGICAL AGENCY: THE TECHNOLOGY PERSPECTIVE

As described in the previous section, end-users of technology apply their *agency* on a technological artifact when they interact with it. However, scholars have indicated that the role that technology plays in the relationship with its end-users is often overlooked (Anaya, 2020; Erofeeva, 2019; Leonardi, 2013; Orlikowski, 2010; Verbeek, 2006). According to Orlikowski (2010), Erofeeva (2019) and Leonardi (2013), there has been a distinction between the "social" and the "material" that cannot account for the ways in which both of these actors are actually entangled. The latter caused the concepts of *materiality* and *Sociomateriality* to emerge.

Firstly, it is best to define *materiality* before we discuss what *sociomateriality* entails. According to Leonardi (2010), *materiality* can be defined in various ways. Firstly, it can just be a physical substance. Secondly, it can be a way in which something 'materializes' from being a theoretical concept into being usable in practice. Lastly, *materiality* can define an 'object' having significance. Within the studies on *sociomateriality*, it is useful to move away from *materiality* as a physical substance or way in which something shifts from theory to practice. Rather, it is best to view technological artifacts (read: digital tools) as artifacts that can be of significance to workers (Anaya, 2020; Erofeeva, 2019; Leonardi, 2010) After all, if a technological artifact is of significance to a user, he or she perceives that the object has a purposeful meaning to them (Anaya, 2020) and allows them to do certain things with it (Erofeeva, 2019). Hence, the user will use a *material* object for achieving his or her goals, therefore applying his or her *agency*. This interaction between a technological artifact and its user can be defined by viewing the technological artifact as *Sociomaterial.*

Leonardi (2013) defines two ways in which one can view an object being *sociomaterial*. That is, it can either be shaped only by the appliance of *human agency* or it is the product of both *human agency* and *technological agency.* Hence, not only end-users possess *agency* because the technological artifact also has its own form of *agency* as well. Leonardi (2013) defines this *technological agency* as the ability to empower humans to act and to act independently on human agency "affording certain uses and actions" (p. 70). Erofeeva (2019) further clarifies this ability by explaining that an object can make someone or something else say or do things throughout the options it provides to them. For example, when end-users perceive that an artifact offers no affordances for action, they instead experience that it constraints their ability to carry out their goals (Anaya, 2020). Hence, a technological artifact forces its end-users to act in a certain way based on the options that it provides to them. The latter causes *human agency* to be constrained by this *technological agency* and causes technological artifacts to become *sociomaterial*. A *sociomaterial* artifact is co-shaped by the constant interaction between the user who tries to achieve his or her goals, and technology who provides a limited set of options for the user to choose from (Anaya, 2020; Erofeeva, 2019; Leonardi, 2013, 2011; Orlikowski, 2010).

The concept of *Sociomaterial* and how it is forged through a combination of *agencies* has been studied by a variety of scholars. Firstly, a case study by Svahn, Henfridsson and Yoo (2009) within a manufacturing company illustrates how a newly implemented technology is not just taken for granted by a workforce. Rather, the results of the study show that 'the evolution of digital technologies in manufacturing is a result of a mangle of sociomaterial practices, resolving various resistance, subjection and accommodation among physical and digital materiality and human agency' (p. 15). Hence, the implemented technology was in fact *sociomaterial*, being shaped by the continuously application of *agency* by its end-users in combination with the *technological agency* in terms of available options of the technology.

The *shaping* process of a technology through a mix of *human* and *technological agency* has been depicted by Leonardi (2011) as *imbrication*. In his longitudinal case study, Leonardi (2011) illustrates how the employees of an automotive company dealt with a new computer-simulation technology for crash-testing. His framework suggests that perceptions of constraint lead people to change their technologies while perceptions of affordance lead people to change their routines. Hence, the new technology within this company can also be seen as *sociomaterial* that is being formed through both *Human* and *Technological agencies.* When the *technological agency* constrained the user, they opted to change the technology. In contrast, when the *technological agency* actually shows affordances to the user, they chose to change their routines. The latter caused the new technology to change in synergy with its context after several *imbrications*, illustrating the entanglement of both the user and the technology in their relationship and how it shapes technological artifacts (Leonardi, 2011). The study of Mbuba, Olesen and Wang (2015) also elaborates on forms of *imbrication* among employees of four institutions in New Zealand in their relation to the IT-systems at

their job. Just like Leonardi (2013) and Svahn et al. (2009), these authors acknowledge that human and material agencies imbricates/entangle with each other and thereby produce various outcomes like new work routines and a reshaping of the used technology in question.

Thus, if we view the human IT-relationship from the perspective of the technology itself, it becomes apparent that the role of the technology is more influential than one may think. Through the *technological agency* in the form of available options and affordances, the artifact constraints *the human agency* of its user. The constant interaction between the two *agencies* results in a technological artifact becoming *sociomaterial* and shapes it into a form that applies to its specific context. The shaping of a technology being *sociomaterial* gives an indication of the *technological adaptivity* that we propose in this thesis. However, it appears that throughout the literature on agency, the user remains to be the sole initiator of adaptivity**.**

TECHNOLOGY PROVIDES, END-USER DECIDES.

To give a few examples, Anaya (2020) states that 'possibilities for action are not pre-defined but are dependent on the technological properties that can be offered (as the material) and enacted with the intent of humans (p. 475) Hence, the user options for reshaping a technology still depend on the options that a technology affords. Thus, if the technological artifact can not offer satisfactory options, it is not going to adapt to its end-user's needs. Leonardi (2011) acknowledges the latter, stating that 'the technology has a fixed set of material parameters that do not change across contexts or groups of end-users (p. 148) and 'Because material agency is circumscribed by the set of features a technology possesses, the technology can only do so much (p. 164). In addition, Mbuba et al. (2015) also argue that 'The imbrications between user and technology depend on the capabilities or skill sets of an individual' (p. 10), indicating that if a technology needs to be reshaped it is going to be because of the user's efforts. In fact, we assume that these capabilities and skills are positively related to our earlier assumptions about the different technological backgrounds of generations.

Thus, it appears from the literature that end-users and technology both have *agencies*, but it is going to be the end-user that is responsible for any form of adaptivity to occur. Hence, when we speak about *Technological Adaptivity,* the leading role of the end-user and the offered pre-set of options that technology provides result in the following and final insight:

Key insight 4: The options that digital tools provide through its technological agency need to be tailored to its end-users if organizations want to avoid the consequences of Agency-conflicts.

With this final insight, the theoretical guidelines have come to their conclusion. Moving on, the four insights will be used to guide the empirical exploration. The latter will be discussed in the next section.

RESEARCH METHODOLOGY

To identify characteristics of *technological adaptivity* within the Human-IT relationship, we used a qualitative research approach. We conducted 12 interviews with end-end-users and designers of digital tools. The group of end-end-users represented *Digital Natives* and *Digital Immigrants*. The interviews all took place in a digital environment, with a semi-structured interview protocol. We were sensitive to available knowledge about possible disadvantages for conducting on-line interviews. Below we show how we have addressed these issues.

ADRESSING ONLINE-INTERVIEW DRAWBACKS

The literature points out that video interviewing comes with the benefits of a decrease in cost and time when compared to a in-person interview (Guchait et al., 2014; Joshi et al., 2020). We experienced these advantages, because no extra expenses had to be made in order to perform the interviews. Moreover, the interviews themselves were possible without finding a suitable location, reducing traveling and scheduling time. We also experienced that scheduling took place effort-less free. The literature also mentions that the quality of online interviews can be dependent on technical- and communicational related issues (Guchait et al., 2014; Joshi et al., 2020). Thus, a poor internet connection could interrupt the fluidity of conversations. Researchers also refer to respondents' possible inexperience with tele-conferencing tools, online conversations and even – inability of interviewees to participate due to a lack of hardware, like a laptop or tablet (Joshi et al., 2020; Guchait et al., 2014). To cope with these potential drawbacks, we first asked if they were comfortable to participate in a video-interview. Secondly, only tools that have been used and tested before and have proven to work correctly, like Zoom and Google Meet, were used to avoid technical issues. Lastly, we guided the interviewee through the tele-conferencing tool if he or she experienced difficulty using the program, using the experience

that we had with these programs.

To cope with possible interviewees' difficulties in communicating via technology, we asked every interviewee to try to "forget" about the screen that they were looking at and to try and see the in-person conversation to empower them to communicate like they would in a face-to-face interview. Secondly, the interviewer aimed his camera in such a way that the face and hands could be visible, allowing the important non-verbal cues to be seen regardless of the fact that the interview was not in-person.

STRUCTURE OF THE INTERVIEWS

An interview protocol (see Appendix A and B) was developed using the four key insights derived from the theoretical framework. Apart from the discussion on these 4 key-insights, a semi-structured approach also left room for additional insights from the interviewees. Thus, we treated these key insights as a guiding foundation for the interview, while the interviews themselves took place as an open discussion. The perspectives of end-users and designers were both needed to uncover the characteristics of our proposed *technological adaptivity*. The end-user works with the technology and therefore experienced the *technological agency* firsthand in terms of provided options, workability of systems and possibilities due to digital tools in their work-environment. Thus, their insights were necessary to check for the specific demands, related to their *agency*, that they had regarding digital tools in their everyday job. The latter related to key insight 1. Moreover, the assumed differences between end-end-users in terms of digi-generations were assumed to cause different *Agency-conflicts*, as stated in key insight 2 and 3. By interviewing both digi-generations, we aimed to check these key insights together with collecting more insights on the existence of differences of interaction with digital tools between the two groups based on their goals and needs. However, characteristics of *technological adaptivity* also steered towards the abilities or functions that a digital tool needs to have. Therefore, the designers of digital tools also had to be included in our data-collection.

The designers of digital tools had the needed expertise on the possibilities of technology in terms of functions and options, considering the fact that they are the constructor and designer the tools themselves. The designers were interviewed based on a slightly differing interview protocol that emphasized towards the technological perspective of the human-IT relationship, mostly covered by key insight 4. The other questions were the same as those for the end-users of IT to allow for additional insights and to minimize missing data, especially because IT-designers were assumed to be more technologically oriented. This protocol can be found in appendix B.

INTERVIEW PARTICIPANTS

We randomly selected and invited the end-user and the designer from any organization for an interview by means of an e-mail, telephone call or in-person approach. The selected 12 interviewees, their job profiles and their respective generation are displayed in table 2. We defined an individuals' generation using an illustration at the end of the interview protocol that implied one's digi-generation and respective term, being *Digital Native* (born after 1980) and *Digital Immigrant* (born before 1980). We replaced the real names of these interviewees by an alias to ensure anonymity.

Table 2:
Interviewee function and generation

Alias	Job profile	Generation
NURSE	Lactation consultant and premature-born baby nurse	Digital Immigrant
POLICE	advisor of capacity management for a Police-institution	Digital Immigrant
FINAD	Financial advisor for a large banking firm	Digital Native
SPEAKER	Public speaker for a governmental organization	Digital Native
SUPPLY	Stock and supply manager for a large retail-company	Digital Native
APPMAN	IT-application manager for a large tech retail-company	Digital Native
ANALYTIC	Manager of the HR-Analytics department of a large banking firm	Digital Immigrant
WEBDEV	Website-developer and designer	Digital Native
BUSAPP	Developer of analytical IT applications for Businesses	Digital native

SALESSUP	Sales-support employee for a large industrial company	Digital Immigrant
WPMAN	Workplace-application manager for a large tech retail company	Digital Native
UNI-ASSIST	Student-assistant for a Dutch University	Digital native

As one can see, the participants worked within different organizations and different functions. There appear to be more *Digital Natives than Digital Immigrants*, but that was due to the fact that the IT-designers were all born after 1980. However, digi-generational differences were analyzed based on end-user interaction questions, whereas the designers were not seen as an end-user of a digital tool. Therefore, the differences between digi-generations should not be seen as biased due to a dominance in *Digital Natives*. Moreover, we performed a demographic analysis on the on-the-job IT-usage of each of the interviewees. As a matter of fact, all of the 8 end-users mentioned that they have to use IT most of the time if not continuously during their job. The interviewees mentioned that this was also the case before the COVID-19 pandemic hit our society in 2020. This pandemic enforced the use of digital tools significantly. We took this event into account during the interviews. We asked if examples and answers could be tailored to the situation before COVID-19 to ensure that the findings of this research are also valid in a post-pandemic work-environment. On the contrary, this increased use of digital tools also enriched the findings, because people were more dependent on, and thus experienced, with them. Hence, the sample consisted of differing end-users that had a lot of experience with digital tools in their careers. For the designers it was not surprisingly to observe that digital tools were the most dominant part of their job routine. However, the 4 designers all had a different expertise, ranging from website design and development to the creation of business-applications for data-analysis (see table 2). Thus, the IT-designers provided data that originated from different aspects within the IT-sector, which fostered the generalizability of our findings.

RESEARCH ETHICS

To protect the interviewees, anonymity was ensured during the entire research process by mentioning this to them at the recruiting phase and throughout the interview. Moreover, we also explained the goal of the research and the role that the respective interviewee had in it to the participants. Lastly, the possibility of recording and transcribing the interview was also discussed with the interviewee. The completed transcripts were stored in a password-protected folder and send back to the interviewee to check if they did not contain any answers that the interviewee did not comply with. The latter helped to reduce possible researcher bias when interpreting the interviewee's messages, because it ensured that the data was the honest opinion of the respective interviewee. Moreover, certain aspects that were not mentioned in the interview but could be of good use were also added by the interviewee's, avoiding the loss of good data. Out of the 12 interviewees, 3 took the option of reading through the transcript.

DATA ANALYSIS

All of the interviews took place in a random fashion, meaning that end-users and designers were not separated into two blocks of only end-users that were followed by only designers or vice versa. Rather, they were interviewed in mixed fashion so that insights from previous interviews could be used in the following ones and could also be compared among the two groups. However, these insights were mere additions, as the interviews themselves needed to be open discussions so that no information was left undiscovered. The interviews were recorded and fully transcribed and notes were taken during the conduction of them. The average time of an interview was 43,55 minutes and the transcripts had an average wordcount of 4.602 words. The resulting transcripts were analyzed through the process of open coding to identifying characteristics of *Technological Adaptivity.* In order to provide the needed structure in the coding process, we used the model of Creswell (2002, p. 244). This model is shown in Appendix C and illustrates the analytic strategy of this thesis. The "themes" generated through this model will illustrate the *characteristics* that appear to be existent as well as the findings on generational differences. The themes were generated through the iterative process of re-reading and continuously filtering and grouping the retrieved insights from the interview transcripts. What is important to mention is that the second step of Creswell's model, the segmentation of texts into different segments of information, was already done when constructing the protocols to ease the analytical process.

The protocols consist of 4 parts (see also Appendix A & B), being *Introducing questions, Technological Background, IT-interaction and Technological Adaptivity*. Whereas the introduction provides general information regarding agency

(goals and needs) and demographics, the technological background section aims to indicate if differences in agency exist among digi-generations. Furthermore, the section on IT-interaction aims to discover certain user preferences and perspectives regarding digital tools to find if there are differences among digi-generations. The designers answered these questions as well to identify if these preferences and perspectives can be made possible, Lastly, the *Technological adaptivity* part was created to deepen the discussion on this concept, and to provide more information on the possibilities for, and thus characteristics of, *Technological Adaptivity.* Hence, the segments tailor the codes to the specific questions that this thesis wants to answer. The coding process was conducted using Atlas.ti and the results were reviewed by peers to foster the inter-coder reliability and reduce researcher bias. During both the interviews and the coding process we were already sensitive to reoccurring topics and remarkable views that became apparent in our data. We undertook several steps within the data analysis to strengthen our arguments and to come to a proper conclusion. These steps can be seen in table 3.

Table 3:
Stepwise visualisation of analytical process

Step	Action
1	Conducting the interviews. During the conduction of the interviews, we were sensitive to reoccurring topics, demands and remarkable quotes and made notes of these. These reoccurring items were brought to the discussion during the next interviews.
2	While interviews were being conducted the finished interviews were already transcribed. While transcribing the interviews we were also sensitive to analyse the reoccurring items. Notes from the interviews were compared with the transcripts to ensure that no valuable data was lost and the transcript was re-read after it was finished. New reoccurring topics retrieved from the transcripts were also brought to the discussion during the next interview(s).
3	After finishing all the transcripts, they were read 2 times before starting with the coding-process to ensure that the themes and topics were clear. A session with the thesis supervisor also took place in which reoccurring topics were discussed.
4	The transcripts were coded within Atlas.ti. During the open coding process, we did not stick to already fabricated open codes. Instead, the transcript was carefully read and every section that contained relevant information for this research was coded. After a transcript was finished, we analysed the open codes that were generated and re-read the previous transcripts to see if new open codes were applicable in that transcript as well. This "feedback-loop" occurred until the final transcript was coded, resulting in continious re-reading of the transcripts and checking the codes generated.
5	The total number of open codes was 129. These open codes were first screened to find redundant codes. Any codes that were found to be similar were merged. The quotations behind these codes were compared to ensure that the merger was acceptable. Another session with the thesis supervisor took place in which coding-process was discussed.
6	We analysed the remaining 118 codes using code-document tables (see appendix D) that visualize the code-occurrence across interviews. We used these tables to filter the open codes down to those who showed clear dominance among the interviews (marked green) or those that were found to be remarkable for this study (marked yellow). We put the 59 open codes that remained in 5 pre-constructed code groups, which are: *End-user agencies; End-user interaction, End-user preferences; End-user perspectives* and *IT-designer perspectives*
7	We analysed the first three code groups individually using their code-document table. During this process we could identify differences or similarities between both end-user groups. We analysed the final two code groups to identify characteristics of *Technological Adaptivity* that are preferred by both groups of end-users and are seen as possible by IT-experts. We therefore compared both of their code-document tables. During this process, we removed more open codes that were not seen as remarkable or applicable after we looked at them for a second or third time.
8	During the writing of the findings, another session with the thesis supervisor took

	place. Within this meeting, certain codes were reaffirmed, adjusted, or denied, leading to a fine-tuning of the code-document tables and findings.

Table 3 serves as a stepwise visualization of the data-analysis of this research. Through this data-analysis we were able to generate interesting findings. These are described in the next section.

FINDINGS

The findings of this study were studied by following the code-groups. Firstly, we reviewed the agencies of both digi-generations. Secondly, the End-user's interaction with digital tools and the demands and perspectives that result from it were described from both digi-generations' perspectives. Lastly, we analysed the perspectives of IT-designers.

The findings were immediately intertwined with research interpretations, which allowed us to bring our original analysis of the data further. By instantly linking a remarkable observation with the insights that were derived in the literature review we reduced the possibility of missing significant information or phenomena.

END-USER AGENCIES: DIFFERING LIFE PHASES

The goals and needs (read: agencies) of the two digi-generations were divided into being either personal or work-related. The *Digital Immigrants* mentioned goals and needs that were directly related to their job or function, as visualized in the following quotes:

"*My goal is to help young parents with their baby. How they have to take care of it and especially how they can understand and take care of their baby in the first year. I want to have enough time at work to do it and not have to much of a workload" (Nurse).*

"My goal is to advice the operational line within the police-organization, regarding the allocation of capacity versus work, as best as possible. With the support of a good office environment" (Police).

"*My goal is to see how we can evoke curiosity within my team for HR and data-driven work. And I ofcourse want to do this in a fun and efficiënt environment" (Analytic).*

My goal is to support the sales-department. Besides that I also want to expand my network and learn how to use certain digital tools in order to stay productive. I have a strong need for a supporting environment at the office to do this (Salessup).

In comparison, when the same question was asked to a *Digital Native* he or she responded with goals and needs that were of a personal nature. This is illustrated by the following quotes:

"*My goal is to keep up with global developments. I don't want to lag behind that is the purpose. I strongly favor a fun and social environment around me when I work in order to remain productive (Finad).*

"Well I have one very large goal and that is to become financially indepent, avoiding burn-out and that I can do anything that I would've wanted at a certain moment. That degree of freedom is what I truly desire" (Uni-assist).

"*My personal goal is to grow in leadership. I have been a specialist for many years and I now see that I have a need to become a better leader" (Supply).*

"*That is a good question. I want to become better in my work and personally develop myself and make more use of data. I need a good and honest work-environment around me to do that" (Speaker).*

This distinct seperation between work-related and personal goals and needs did not come as a surprise, because we brought the element of age into the analysis. The *Digital Immigrants* were all of an older age when compared to the *Digital Natives.* Whereas *Digital Immigrants* were working for a significant amount of time and most often were already close to their pensions, the *Digital Natives* were at the start of their career and thus were more personally-oriënted and forward-looking. However, we observed that the digi-generations in the sample did not feel a negative influence of digital tools on their agencies. As a matter of fact, they both viewed IT as an enforcing element regarding one's goals and needs, which was visible within the following quotes:

"The urgency to keep up with the developments has become bigger for me due to these IT-applications. They show me what I have to prepare for and what is possible" (Finad).

"*I think that the because of IT-applications chances and oppertunities are becoming visable. They make things measurable and you can see where you need to develop. Thus, if I want to develop myself I use them and if I want to use data they strenghten that goal as well" (Speaker).*

"*The technology makes the supporting of the sales-department a lot easier and also allow me to deepen my knowledge in a quick fashion, due to the easy accessability to information" (Salessup)*

"*When we talk about advicing the operational line and allocating capacity, yeah IT has played a major role in that and without it I can not perform my job as well as I can now" (Police).*

"*Look those IT-applications allow me to perform my job regardless of location. And so far that has worked perfectly making it a huge benefit. I can sort out my own agenda in that sense" (Uni-assist).*

"*Yes because I am unable to peform my work and make people more data-oriented without them. And I mentioned an efficient work-environment, which is empowered by collobaration tools like Microsoft Teams" (Analytic).*

Hence, the two digi-generations did differ in terms of agency but the *Agency-conflicts* that we assumed to orginate from these differing agencies were not apparent. On the contrary, both *Digital Natives* and *Digital Immigrants* felt that digital tools at their work place enforced their goals. We did not expect this synergy between the *Technological*- and *Human Agencies*. Moving on, we took a closer look to the possible differences in the interaction with digital tools between the two digi-generations.

END-USER INTERACTIONS: POSITIVE EXPERIENCES

Overall, the digi-generations in our sample did not show significant differences regarding their interactions with digital tools. We saw a number of positive experiences among the two groups. First, both *Digital Natives* and *Digital Immigrants* mentioned that they experienced the overall influence of digital tools within their work as positive. The latter is illustrated by the following quotes:

"*You do not only see it with our stock-taking tasks but also with registration of certain sale loops in our systems. Everything is just supported better by IT-systems" (Supply).*

"*I have never seen it as a threat. On the contrary, I have always embraced it because it helps you in so many cases. I never found it annoying" (Salessup).*

"*I see it as very useful, not neglecting the fact that me and most of my fellow colleagues saw it as a very large step" (Nurse).*

"Yes, I think I can work more effectively and that makes me satisfied. I can also visualize certain things to our costumers and communicate in a much quicker fashion" (Police).

"*It makes work easier and registrable. With that I mean that you can always look back due to IT-tools and that makes the whole thing very supportive in work-processes" (Speaker).*

"If everything works fine, then I think it is perfect" (Uni-assist).

Hence, both *Digital Natives* and *Digital Immigrants* viewed digital tools as something very positive in their work environment which contradicted an earlier statement. It was assumed that *Digital Natives* would be more comfortable with digital tools than *Digital Immigrants*. However, we observed that these *Digital Immigrants* also had a positive view on them. Secondly, when we narrow the scope down to the specific interaction with digital tools, both digi-generations generally mentioned that they allowed for a more efficient and effective way of working, as can be seen in the following quotes:

"*When I am in a meeting with parents and I talk for half an hour, they often only remember 10 minutes of it. I can now tell them to scan a QR-code or to go to the website of the hospital where everything is worked out for them" (Nurse).*

"*Well, that I don't spend hours on a typewriter to draft a police-report. And that I can correct mistakes very easily. I do not have to use Typex to correct errors or re-write entire pages" (Police.)*

"What I find most useful is that we can literally monitor everything. We can also calculate everything which saves us a lot of time while working out certain underlying formula's in our work. If I look at the past and people needed to do all those calculations on paper I can imagine that it would take a lot of time" (Finad).

"*Well we have a computer that functions 24 hours a day here. In the past we had to start up the process and manually copy and paste everything into a variety of systems. If you compare that to the present where all those things are happening in the background and everything is already up-to-date when we enter the office, instead of needing 1 and a half hours to do it manually, you can automatically see the benefits of the IT-tools" (Supply).*

"*Well, in the past when multiple people were working in one document you continiously had to save and send the file back and forth which costs a lot of time. Now we just work together in one document and we can negiote while doing so" (Analytic).*

"Well, if we talk about the application that I use for my university-job I can use it to reach out to all the students at once. I can for instance post certain messages on a discussion board and they will all get notified" (Uni-assist).

Hence, both digi-generations mentioned that their work became more efficiënt and effective due to the presence of digital tools. Lastly, we observed that every interviewee experienced digital tools to be supporting in their job. The latter is bilateral, because it meant that they either found it easier to work due to to them and that they helped them to peform, or it meant they simply needed a digital tool to perform their tasks. The latter became apparent within the following quotes:

"*Well for instance that I use Excel to make a lot of graphs and statistics that I can then present. In general, IT simply supports me in my daily work" (Police).*

"*When I administer medicine I use an application, checking my mail for questions is of course an application. And whenever I need any information regarding medicine I check another application where I search certain protocols for my work. So that is basically how I perform my job" (Nurse).*

"And I use an application where I enter the annual numbers of a company. From there we start the sale-procedure that for example results in a loan or credit. The core is that whenever we deliver something we have certain conditions that are automatically calculated by that application. So the only manual action is to check the matter and give our advice" (Finad).

"I think that, generally, IT is a supportive factor in any process. That is how I have experienced it" (Speaker).

"*Well, for example I had to travel abroad and I needed to maintain the contact with a lot of people. The digital tools allow me to do that regardless of time-zones and location" (Supply).*

"*I have to advice multiple salesmen during their work-day and for example microsoft teams helps me a lot with the communication. I am able to share information across the entire globe" (Salessup).*

Thus, all of the end-users within our sample appeared to have a positive view on the presence of digital tools in their work-environment and they experienced them as a supportive element during their workdays. We found this interesting because it was assumed that *Digital Natives* would be more optimistic about digital tools than *Digital Immigrants*. However, we observed a shared optimism between the two digi-generations. Moreover, the quotes mentioned above also indicated that both digi-generations made active use of digital tools either because they had to or because they wanted it themselves. It was assumed that *Digital Natives* would show more active involvement with digital tools, but this does not seem to be the case within our sample. Apart from these positive experiences, the end-user interactions also lead to negative experiences regarding digital tools.

END-USER INTERACTIONS: NEGATIVE EXPERIENCES

We observed that both digi-generations mostly experienced the same frustrations when working with digital tools, apart from one differing topic. First, we found that a failing digital tool was a common cause of frustrations. This was illustrated by the following quotes:

"I have for instance experienced that I had a group of 30 people in a conference-room, but the beamer and powerpoint-presentation would not work. You know, that I had a presentation but the technology failed to work" (Nurse).

"*And if I can't proceed because it is not working again, the internet is not working or there is another system-error or the like. Let me say, than I need to count to ten while sighing heavily" (Finad).*

"Well firstly, it sounds very simple, but failures. If you are very dependent on certain IT-systems and they don't work, then it is just blocking you to do your daily tasks" (Speaker).

"Like I could not call my collagues again or Teams was malfunctioning again, that really blocks your productivity" (Analytic).

"Well it is at that moment that when there is a malfunctioning in your IT-infrastructure that you know that you can not do anything anymore. You just sit in your chair and wait till the problem is solved" (Uni-assist).

"*Well if I can not perform my tasks anymore because a IT-application is not working. That is mostly due to the internet connection though" (Police).*

Thus, in most situations a failing digital tool left an end-user unable to perform his or her tasks, which blocked them in their productivity. As a matter of fact, the police-advisor already introduced the second negative experience, namely: a failing internet connection. We heard voices from both digi-generations that internet connections were also a common cause of their negative experiences

with digital tools, which was visible within the following quotes:

"During the moment that my VPN-connection is instable it has such an influence that I sometimes had to wait for half an hour until I could do something. That caused me to be really grumpy for the remainder of the day" (Finad).

"Well for example we now see a lot of restrictions regarding the uploading of files to our cloud. In the past we used a hard-drive but now we have to connect everything to a cloud where everything has to be uploaded" (Supply).

"If it works it is fantastic, but at the moment of the day that a VPN-connection begins to underperform it becomes horrible" (Analytic).

"It does not really matter what it is, a device functions quite well on its own. It is most often the network, like a Wi-Fi-connection, that causes trouble" (Salessup).

"Like you are working on the internet and a certain SAAS-solution that I need is not working again" (Speaker).

"Well, if I have to use a heavy-loaded excel application I most of the time can go grab a coffee and take a break because it does not work. But that is related to the glass-fiber cable that provides internet connection" (Police).

Lastly, we observed that both end-user groups found it very frustrating when they had to take unnecessary steps while using a digital tool. The following quotes describe this:

"Before the system gives me what I need I have to come up with certain terms and adjust my input three times before it gives me what I want while the protocol that I need is quite obvious for the department I work in" (Nurse).

"Well, we use our scheduling system is with several mouse-clicks and keyboard combinations. But we call it click-till-you-drop because we have to click 100 times in order to adjust 1 simple thing" (Police).

"I find the expert-environment to be nice because I can approach several platforms and retrieve data without having to do any complicated stuff" (Analytic).

"The number of steps that you have to take in order to activate or complete a certain function. For instance, our new press-questions system where you have to go through 8 steps before you can save something. And if you do not perform 1 step you get instantly get a message saying you need to complete that step first. That blocks you sometimes" (Speaker).

"It always has a reason. For instance, we started when I joined the Hengelo office I was surprised by how difficult we made it for ourselves. Clicking every link and opening everything in a mobile application" (Supply).

"We had an EPD and I had to log in via the browsers. Then I got a text-message with a verification code on my phone before I could get in the application. And with another application I had to use a Citrix-environment which was not available on every computer because you needed a certain connection. That was quite cumbersome" (Uni-assist).

Hence, end-users from both digi-generations mentioned that having to take a lot of, in their eyes, unnecessary steps also felt as a negative aspect of digital tools. Apart from the negative experiences that became apparent among the two groups, we observed only one negative experience that was mentioned by only one of them. The *Digital Natives* mentioned that they experienced an overload in available digital tools, visualized by the following quotes:

"*It is not always kept up-to-date, meaning that there are so many possibilities causing me to be unable to keep an overview of it all. It is not clear, when you need something specific for your work-routine you could drown in it so to say" (Finad).*

"Well, that is a downside of working within the municipality. A lot of separate applications are connected via a lot of little backdoors. That is because you also have a lot of separate suppliers of these applications depending on the departments at our organization" (Speaker).

"There are beautiful systems but there are a lot of people that tinker something new to them. There are like 10 new possibilities, but they are mostly not used" (Supply).

"I for instance had to handle six electronic patient dossiers. Apart from that I also had my financial applications, my communicative applications and so on. So, a lot that was mixed through each other" (Uni-assist).

We assumed that this phenomenon was caused by their 'more advanced' technological background. They had experienced digital tools starting from their studies and seemed to be more broadly oriented within the digital tools that are offered, causing them to experience an overload of them. However, this could also be tied to their specific organizations that were providing to many applications to its workers. However, we concluded

that apart from this finding which only accounts for *Digital Natives,* the digi-generations do not show distinct differences in their interaction with digital tools. We did not observe a dominance in difficulties which we assumed to be existent within the *Digital Immigrant* group. In fact, only one *Digital Immigrant* expressed personal difficulties regarding digital tools, which was visualized by the following quote:

"*Yes it is just like what you are mentioning. I do not really know how it works and if I need to start it up myself I get really insecure" (Nurse).*

However, this nurse also introduced one of the most interesting findings that accounted for end-user interactions, especially from a *Digital Immigrant's* perspective. The quote stated:

"*I now experience less difficulty, because I know how it works" (Nurse).*

END-USER INTERACTIONS: LEARNING AND AFFLUENCE

It became apparent that end-users of digital tools, especially *Digital Immigrants*, either learned how to use them in their everyday job or had affluence with them. In fact, the concepts of "learning" and "affluence" were visible among both digi-generations. Firstly, we observed that *Digital Natives* had indeed "grown up" with digital tools as mentioned in the literature. They therefore already possessed adequate experience and knowledge. The latter was illustrated by the following quotes:

"I have studied Business Economics and because of that I have a good amount of experience with technical applications and IT-applications" (Finad).

"My background is Hotel Management School. During those times I had a lot to do with digital systems, IT-systems ranging from algorithms to more basic functions like outlook. Thus, I have a background, but I did not specifically study IT" (Speaker).

Thus, the early exposure to technologies of *Digital Natives,* as mentioned within the literature, becomes apparent in these quotes. We observed that they experience less difficulty with digital tools because of this prior knowledge. In fact, they mentioned this themselves as well. The latter was illustrated by the following quotes:

"I think that, when I compare it with my older colleagues, my young age and IT-experience makes that I can use and adopt the digital tools much quicker" (Finad).

"Well, If I want a certain application for the organization I have to consider that it is also suitable for my colleagues that are like 60 years and older. If I do it for my generation I can make it much more complex" (Speaker).

"The people that worked at the back-office were a lot older than me. I noticed that in terms of thinking-capabilities en the speed of learning things I had a significant advantage with digital tools as opposed to them" (Uni-assist)

Secondly, we assumed that *Digital Immigrants* would have more difficulty with digital tools because they "missed" growing up with them. However, we observed that this was not the case. The *Digital Immigrants* depicted that they had either learned how to use digital tools or that they had affluence with IT in general causing them to have adequate knowledge of digital tools. They therefore did not "miss the boat" by not growing up with digital tools. In fact, some of the *Digital Immigrants* mentioned that because of their affluence towards the new IT-technologies, they did not miss any of the developments that took place when IT was still an upcoming phenomenon. The latter is illustrated by the following quotes:

"In 1984 the police retrieved the first computers in a project. I was one of the first to be interested in that and was appointed as an instructor for that project" (Police).

"When I was still studying people started with programming in all kinds of programmer language. I was interested in the usage of a certain device and what you could do with it. I saw it as something very good, not a threat or anything" (Salessup).

Third, apart from having affluence and/or experience with digital tools both digi-generations frequently mentioned that they do not face a lot of difficulty using them because they learned how to use them. The latter is illustrated by the following quotes:

"Yes everything is going fine now, it could be a bit more simple but it works because I now understand how it works" (Nurse).

"For example, someone build a new application within Excel that is not supported by our IT-department. But he then explains it, and when he has given that explanation we understand it and we can pass on that knowledge" (Police).

"You often have to use them so much that it becomes a habit" (Analytic).

"I always try to develop my knowledge on these tools, like using media-tools in my work" (Salessup).

"Well let me first say that my development with IT-applications is limited. But I possess a lot of knowledge of our BBS-system, purely because I taught myself how to use it" (Finad).

"People need to know why they are going to use a certain application, and also how that can use that application" (Speaker).

"At the beginning you do not know all of the possibilities, but that is more the cause of inexperience. Learning how to use them makes you a lot stronger in dealing with them" (Supply).

"I did not know how the system functioned at the time, but that is not a big problem because everyone has that at a certain point" (Uni-assist).

Thus, it appears that end-users from both digi-generations did not face a lot of difficulty using digital tools in their work-routine. We assumed that especially the *Digital Immigrants* would face more issues with the usage of digital tools than the *Digital Natives,* but we observed that the experienced difficulties with digital tools were not distinguishable between the digi-generations of our sample. Above all, we found that the presence of adequate knowledge and experience with digital tools, either through affluence or learning, had a positive effect on user-technology interaction. A set of demands originated from the end-user interactions with digital tools.

END-USER DEMANDS

Almost all of the uncovered demands were applicable to both digi-generations within the sample, apart from two distinctive ones. Firstly, both end-user groups mentioned that they demanded 'accessibility and performance' from digital tools, which in simple terms meant that they "worked". We saw this as a direct response to the difficulties regarding system malfunctions and internet-connections that originated from the end-user interactions. The demand for accessibility and performance was visible within the following quotes:

"That they do what they pretend to do. That they are available. The availability of an app is conditional if I want to do my job" (Police).

"It actually became like a commodity. You just expect it to work and if it works than you do not hear anyone complaining" (Analytic).

"Let's propose first that they just work, no open-ends. That's a simple one" (Salessup).

"Stability, that is something that I think is very relevant because I get very annoyed when it is not working properly" (Finad).

"Well, IT-systems need to work. If I want to do my job properly I need stable systems, as simple as that" (Speaker).

"Well, that are the most important things for me, that it is stable and that it works" (Supply).

We observed that the demanded accessibility and performance was frequently mentioned as the first thing that came to mind. The end-users simply wanted digital tools they could rely on and that did not block them in their work-routine in order to work fast and efficient. Secondly, we found that both end-user groups demanded synergy and overlap between the digital tools in their work-environment. The latter meant that that the digital tools were connected with each other so that work became simpler and more efficient, as can be seen within the following quotes:

"In the first place that those systems can communicate with each other. That when I write something down in one system it can get adopted by another system" (Police).

"I think that like the connectivity between things is going in an increasingly better direction. You can take office 365 as an example" (Analytic).

"We need to search in a different system, but it would be much better if you can, for example, have a link in a report about a baby that is born to early that instantly shows the significant information from that other system" (Nurse).

"Well, our BBS-system does not say you are doing something wrong. It is not the case that it matches itself with another system to uncover certain errors, but that would be a big improvement" (Finad).

"Well, you have a lot of systems that differ from each other making you less productive than if you had 1 system that is connected to all these differing applications. A more integral approach" (Speaker).

"For example, that a report is saved in one sharepoint, but it has to be manually shared with other Sharepoint. Why not one file that Sharepoint and another one in the other Sharepoint that communicate with each other?" (Supply).

Third, both digi-generations also demanded that digital tools communicated with them. They mentioned examples like pop-ups that reminded them of upcoming tasks, notifications that certain actions contained errors which needed to be solved and other actions that made the digital tool a type of "virtual-assistant" to its end-user. The latter was depicted within the following quotes:

"It could for example just be with pop-up windows that remind you of certain things or that tell you that what you are about to do is not possible" (Police).

"Yes, for example that when I drive my car and I am not paying attention I get an alert that I am crossing the line across the road. He therefore gives me a signal that I need to pay attention. I think that this kind of technology should be much more incorporated, feedback from a certain application" (Salessup).

"You can compare that with a computer that is smart enough to tell me that I have a certain conversation coming up or that I have not sat down with one of my team-members in 4 weeks when compared to the others" (Analytic).

"The system can not tell me where a certain mistake is made. It is very sensitive to mistakes and it would help me if in any way it can give me feed-back on certain mistakes" (Finad).

"Certain quality-checks are now being done by systems instead of specialists. The system is now checking us, it allows for less mistakes" (Supply).

"That it gives me an indication whenever I am about to do something important. Like are you sure you want to do this?" (Uni-assist).

Lastly, both digi-generation described the preference for easy-to-use, clear and self-explanatory digital tools. Throughout the data-collection and analysis we found that these aspects were actually part of an umbrella term, namely: *Intuitiveness*. We chose to use *Intuitiveness* to describe these aspects because both end-users and IT-developers used this term frequently. In fact, it proved to be a concept that was closely tied to our proposed *Technological Adaptivity,* and it was illustrated by the following quotes:

"Those applications need to be much simpler. I have to be able to type something in terms of slang and still be able to find what I need, and there need to be multiple ways to get to the same protocol" (Nurse).

"So, if you do not use a certain system that often it has to be entirely self-explanatory how you get to something that you need. In expert-systems it can be quite a puzzle to get to where you want to go" (Analytic).

"I think it some people about 6 to 7 years before they were able to work with it, because it was not built up logically" (Police).

"Whenever I open G-mail I know exactly how I can compose an e-mail. There is a logo with the right color that even my grandmother can find. That is how I think an application should be designed" (Speaker).

"And there were so many templates within that application that we could not figure out how to correct something. That is what I find most annoying, speaking in terms of user-friendliness" (Finad).

"I found it a very user-friendly application and I think that is very important" (Uni-assist).

Thus, both digi-generations depicted similarities in demanding accessibility and performance of digital tools. Moreover, they also both favored digital tools that are synergized with each other and those that communicate with its end-user in terms of feedback and informative messages. Lastly, they demanded *Intuitiveness* from digital tools which makes them user-friendly and self-explanatory. Apart from these similar demands, we also uncovered demands that were applicable to only one digi-generation. Firstly, the *Digital Natives* mentioned the importance of hardware when talking about their preferences. The following quotes depict this:

"But also, the quality of IT. I have a work-phone here that you can get for under a 100 euro's. If I open the NOS-app it already malfunctions. I have to get my new iPhone in order to work" (Speaker).

"Simply said, you can have the most incredible IT-system but if you do not have the required material to work with it, you are back at square one" (Supply)

"Well, I demand speed, a good internet-connection but also a good computer that operates it. And a second monitor" (Uni-assist).

It could be possible that the *Digital Natives* oriented themselves beyond the software-aspects of digital tools. We related this to earlier assumptions and findings within this research. We observed that *Digital Natives* grew up with IT and experienced it at their studies and early careers. Therefore, they could have been more broadly oriented towards the concept of IT than *Digital Immigrants* and thus expected more than only software-related aspects as described by key insight 3 within the theoretical framework. Hence, they appeared to strive for different goals than *Digital Immigrants* did. The overload of IT-applications that was only being experienced by *Digital Natives* is another example. However, the *Digital Immigrants* mentioned that they either had affluence with IT and/or had learned how to use the digital tools. Thus, we found it notable as to why they did not mention hardware in their answers. We thought that the latter could be as dependent on personal preferences as it could be on the difference in digi-generation, and thus

viewed it as a notable phenomenon for future research. Apart from the *Digital Natives,* the *Digital Immigrants* also had a demand that only accounted for their digi-generation. They mentioned that they preferred systems that had an aspect of intelligence within it. The latter is depicted in the following quotes:

"Well in terms of supporting, you also have that assistant that Google has developed. It is constantly learning, and I can imagine that it is going to automatically do certain tasks for you" (Police).

"Like in terms of intelligence of an IT-application. That it sends you personalized messages, it reads your agenda and messages you that you have been typing for too long. It is possible and it is going to be upcoming, I am sure of that" (Analytic).

"Like that everything shuts off so that I can concentrate on my book that I am reading. Or that it registers that certain people are actively participating in a meeting. Asking intelligence from applications is what I mean" (Salessup).

Hence, the *Digital Immigrants* demanded that digital tools possessed intelligence and therefore assisted them in a more personalized matter. This observation was notable because intelligent digital tools should have been of more interest to the *Digital Natives*, based on our observation and assumption that they expect more from digital tools. However, they did not mention aspects like these while the *Digital Immigrants* did. We assumed that their agencies were the causal factor for this finding. Whereas *Digital Natives* depicted goals related to personal growth and the future, the *Digital Immigrants* displayed solely work-related goals. Thus, it could have been the case that the *Digital Natives* wanted to learn themselves and therefore did not seem to care about the application learning from them. In contradiction, the *Digital Immigrants* wanted to perform their job as good as possible, and what better than a supporting digital tool that improves based on their interaction with it. We therefore assumed that a difference in agency caused this specific demand to originate among *Digital Immigrants*. However, we could generally conclude that the digi-generations in our sample showed a dominance in similarity regarding their demands. We summarized the demands per digi-generation in table 4. We continued our analysis with the perspectives of both digi-generations on *Technological Adaptivity.*

Table 4:
End-user demands per digi-generation.

Digital Immigrants	Digital Natives
Accessibility	Accessibility
Performance	Performance
Intuition	Intuition
Synergy	Synergy
Intelligence	Hardware

END-USER PERSPECTIVES

We uncovered several perspectives on our proposed T*echnological Adaptivity* among both end-user groups. In fact, both groups did not show any difference in their perspectives. First of all, there was a general consensus among end-users regarding the need adaptive digital tools. As illustrated by the following quotes, end-users acknowledged the need for them:

"Well, I think that IT needs to adapt to its user regardless of the amount of influence that it has or gets" (Analytic).

"I think that technology is continuously developing based on certain needs, so yes it has to be adaptive" (Salessup).

"If IT adapts to its users then it become more usable, which makes it easier for the user. so, I think that it needs to adapt" (Nurse).

"If you want to create a supporting base for an application or certain process you need to adapt IT to its user, or they will not use it at all" (Speaker).

"Well, it is very dependent on the users, who have differing demands. So yes I do think that it needs to adapt" (Supply).

"Is that not already happening? Is it not the case that we make IT-applications as human beings to make our lives easier? They are therefore adaptive to our lives" (Uni-assist).

However, these quotes had to be seen as bilateral. We heard voices that acknowledged the need for digital tools that adapt to its end-users because it made their work easier, but that was seen a logical explanation. What we found more notable was that end-users already experienced that digital tools were of an adaptive nature like the speaker, supply-specialist, university assistant and sales-support employee. We heard voices from both digi-generations that described their experience of evolving- and adapting digital tools within their work-environment. The latter was illustrated by the following quotes:

"Well, I think that you can already experience that IT is adapting. Like talking to your navigation system to operate it et cetera" (Police).

"Well, you can see that with Office 365 for instance. That is something that is only from the past year and a half. We did not have a good mobile version but now everything works and is seemingly integrated with each other" (Analytic).

"Well in a certain way yes, but I experienced IT to develop based on a certain need. It is not like the firm Google is spontaneously thinking about developing a conference app. That is based on certain people having a need for it" (Salessup).

"But also, when we talk about IT-businesses that make the applications, they make it in synergy with the business process, but they see the importance of the user. Thus, the applications that tailored to a user will be purchased much faster than those that offer like 500 different options" (Speaker).

"If you look at our stocktaking you can see a significant improvement when you compare old with new. The input is fine only the analysis can be better but that is what they are now developing" (Supply).

"I think we develop those applications based on our needs. And those needs are identified within the market-research that those IT-business undertake" (Uni-assist).

These quotes were remarkable when we compared them to the insights that we retrieved from the literature review. Whereas it appeared that digital tools were rigid and that any form of adaptivity was to be initiated by the end-user, we observed that the that the digital tools were actually adapting independently of the end-user's requests. Within our sample, end-users experienced that digital tools are designed based on needs and that the end-user seems to be incorporated within that design. In fact, we heard voices that talked about this incorporation of the end-user, as visualized by the following quotes:

"Well, I was responsible for the implementation of a system for my organization, so I know how that goes in practice. In general, I can there is an entire team behind every application the firm provides. I have been to a meeting that was solely about how the end-user will be incorporated within the design" (Supply).

"Well, we are about to receive a new scheduling system. At that moment there was someone that approached us and said: "You are about to receive a new scheduling-system, what needs to be included in it?" (Police).

"Well not only HR but also IT asks the workers what they think about our systems. We also have pop-up surveys within those systems that ask you about your experiences and if you have any suggestions for improvement when you are using them" (Analytic).

"Well, they do take the differences in departments into account. If you for instance work in the finance department you get a different system than those who work in the client-management" (Speaker).

The latter indicated that the digital tools that were available in the work-environment were not as rigid as we assumed them to be based on the literature. Apart from these rather positive perspectives on *technological adaptivity,* we also observed that a number of restrictions were present. According to both digi-generations there were organizational- and financial restrictions regarding adaptive digital tools. They depicted them in the following quotes:

"Well, if you want to change something that is tailored to our specific department than I wish you good luck. Our organization has 15 departments that all want their own specific thing from the system, and that is of course not very realistic" (Nurse).

"Well, that takes a long time, because they first look if there are more people that also want your requested change throughout the nation. And they only adjust it if certain percentages are met, because it of course is very expensive as well" (Police).

"Well, I think it is very hard because work in a gigantic organization. It is very difficult to give everyone a special treatment" (Finad).

"Well, it is more of a dilemma between wanting something and being able to do something. There is a lot to change but only if your organization wants it and if a lot of money is invested" (Uni-assist).

Thus, the scale of an organization and its financial intentions had an influence on the adaptiveness of digital tools towards the workforce within our sample. We uncovered one more factor from both digi-generations, namely the interpersonal differences among end-users of a digital tool. This was observable within the following quotes:

"Not individually, I think that they want to fulfill a generic need with IT-applications. I do not think that you can individually adjust a system for thousands of employees that all differ in preferences" (Speaker).

"Like a logistic person wants graphs and statistics whereas for instance a sales-employee wants something entirely different" (Supply).

"Well not for everybody, that is impossible. You can send your feedback but that does not mean that it will automatically gets adjusted" (Analytic).

"It would be very easy if that were possible. But I don't think it is that easy to do because no person is the same" (Nurse).

"Well, if something does not work we have to be able to provide feedback. But I think do not think that 1 thing has to adjust to 100 people, rather that 100 people have to adjust to 1 thing" (Finad).

"Well, you look at a need and you want that technology adjusts to that need. But my needs are of course very different than for example your needs" (Salessup).

Thus, apart from organizational size and financial intentions that restrict the adaptiveness of digital tools there were also interpersonal differences between individuals. Based on the experience of the digi-generations in our sample it was simply not possible to take every individual's needs into account in terms of time and expenses. Having described this final perspective, we summarized the perspectives in table 5. We then moved towards the IT-developers insights to see whether their perspectives are similar to those of the end-users.

Table 5:
End-user perspectives on *Technological Adaptivity*

Perspectives of both digi-generations
Acknowledgement of the need for adaptive digital tools.
Experiencing adaptive digital tools
Experiencing evolving digital tools
Incorporation of the end-user within IT-design
Organizational restrictions on adaptive technology
Financial restrictions on adaptive technology
Interpersonal differences regarding adaptive technology

IT-DESIGNER PERSPECTIVES

During the interviews and the data-analysis it became clear that IT-designers had similar perspectives towards our proposed *Technological Adaptivity* when we compared them to the end-users. Moreover, we observed that IT-designers are continuously working to improve their products and viewed the end-user as a very important stakeholder within that process. In doing so, they were, remarkably, working towards meeting the demands that were mentioned by the end-users of our sample. Apart from the perspectives that enable the possibility of adaptive digital tools, IT-developers also mentioned the same restrictions as the end-users while adding technical elements as well. Finally, it appeared that IT-developers are experiencing a change within their design-process that acknowledges the end-user within the development of a digital tool. We segmented these findings based on four themes, namely: *Developing for the end-user, User Experience, Restrictions on adaptive digital tools* and *An Adaptive future.*

IT-DESIGN: DEVELOPING FOR THE END-USER

We observed that IT-developers are continuously working to improve or optimize processes and the digital tools that are used within them. The latter was depicted by the following quotes:

"A big part of my job consists of process optimization, meaning that users need to work as efficiently as possible" (Appman).

"Well, you have continious development in for instance AdobeXD. The designers of that application saw that somethings were not quite as efficient, so they made a new, more easy-to-use application" (Webdev).

"The direct result that we observe is that we create efficiency. We for instance make sure that people don't use Excel, but that one system will be introduced that is workable for multiple people" (Busapp).

"I generally make certain tools for process optimization. That simply means that everything works optimally and efficiently" (Wpman).

Hence, the job of an individual that works within the IT-sector consisted of the optimization of processes with the use of a digital tool or application. Remarkably, we observed that according to the IT-designers within our sample, the optimization of digital tools and applications was closely tied to their end-users. In fact, we heard voices that the general function of IT was to support the user's of their products. The latter was visualized by the following quotes:

"Well, I am very service-oriented. IT is a supportive function. We support the user and that has always been the approach of IT in general" (Appman).

"Well absolutely, I always design something in accordance with the goal of its end-user. After

having done that I focus on the goals of the other stakeholders" (Webdev).

"Well, that is also my goal, costumer-satisfaction. So, everything has to work flawlessly for a user" (Wpman).

"Well, you have to give them all the options that they want. By all means you have to think about everything that a user might need, but that is obvious" (Busapp).

Moreover, we also heard voices these products are tailored towards a certain audience or business sector as depicted in the following quotes:

"*It really depends on the target audience. I always start by talking to the costumer in terms of what is your target audience, what do you want to sell. If the target audience is above 50 years of age I make a much clearer and easier to use website than if the target audience is like 20 to 30 years of age. Then I can make it much pushier and trendier" (Webdev).*

"Well, I generally make applications based on for businesses. Sometimes we bring something to the market because we feel like something is missing, but in most cases it is made on customer request because they need something specific" (Busapp).

"Well, much of the developing is done based on costumer request. You see that a lot more nowadays, like for instance cloud-solutions that become a lot more flexible" (Wpman).

"Well, you have the general solutions that you can buy and instantly implement like Microsoft Office. But you also have applications that are internally developed for a certain business" (Appman).

Thus, it became apparent that digital tools are designed and developed based on a certain audience and that IT in general had to be seen as a function that supports the end-user of its products. The latter contradicted our earlier assumption that the adaption of digital tools was primarily driven by the end-users efforts. Hence, an *Agency-conflict* between the technology and the end-user would result in the adapting of the technology in question, but we observed that tools are developed to serve the needs of an end-user in the best way possible *before* it is implemented. In addition, we also observed that end-user's efforts are indeed an important driver of technological change *after* implementation. We heard voices that user-feedback serves as one of the main drives of the optimization of digital tools. The latter was depicted within the following quotes:

"Well, we sometimes try to use our applications in practice to see if it functions well or not. In this way we keep back-logs that allow us to tackle certain bugs or improvements. For example: we had a complaint from our call-center that 40% of the incoming calls were about delivery time. We therefore adjusted their applications to instantly show delivery times which made their work a lot more efficient" (Appman).

"Well, a very good example is the development of Windows. Windows XP became Windows Vista, and everybody still understood how to work with it. Then Windows 7 came, and it was still fine. But with the arrival of Windows 8 everybody was like how am I supposed to use this? Microsoft was like: "That was a mistake, here is Windows 10" and then everybody was satisfied. That are the kind of developments that you have to experience in order to improve your product and it is user-friendliness" (Webdev).

"Well, if you ask me what needs to be changed than it comes down to improving all the points mentioned and adding what is missing. That generally comes down to listening to the feedback that you receive" (Busapp).

"I think that a great example would be Microsoft Teams. They have a website that allows its users to share their ideas and they can vote on other ideas. And then you see a request that gets a lot of attention to become implemented in the application, thus at the user's request" (Wpman).

Hence, the user's efforts were recognized by IT-designers because it allowed them to further improve their products. In fact, we observed that the demands mentioned by the end-users of our sample are actually being met in this manner. For example, the demanded synergy between digital tools became apparent throughout the following quotes:

"For example: I have developed a tool that if you fill in a username in a certain application it will automatically retrieve information from a variety of systems" (Wpman).

"We provided a system that was much clearer in terms of overview and everything was connected with each other" (Busapp).

Furthermore, the demanded *Intuitiveness* was also observable within the following quotes:

"Well let me frame it like this, a human being steers on its intuitiveness. An application needs to be connected to this intuitiveness, users need to instantly know where to click and how it works" (Appman).

"That needed an easier-to-use application. So, you got like AdobeXD, Figma and another one. They

made it easier to design and you see this in the design of applications as well, they contain less detail and become more self-explanatory" (Webdev).

"It needs to be self-explanatory in a sense that the user never has to ask you how to get to a certain point within the application" (Busapp).

"Well user-friendly of course. If you talk about visual aspects like interface it has to be clear and user-friendly" (Wpman).

Hence, we noticed that the digital tools were not as rigid as scholars depicted them to be. In fact, we observed that the job of an IT-developer was to support the end-user and that digital tools were created and developed based on their needs before and after implementation. The latter was visualized by the fact that our uncovered demands of end-users were already considered by the IT-designers within our sample. Hence, the development of digital tools was often based on the feedback, which can be seen as the direct result of the *Agency-conflicts* between the technology and the end user that is depicted in the literature. However, what we find more notable is that this interaction between the user and the technology is the not the main driver for the adaptation of digital tools, because the technology was also tailored towards it's end-users before it was implemented. More importantly, we observed that there is a common term wherein these efforts of IT-designers before and after the implementation of a digital tool come together.

IT-DESIGN: INTRODUCING "USER EXPERIENCE"

Throughout the interviews with the IT-developers, we observed that there was a common denominator for the incorporation of the end-user within the design process, namely: *User Experience*. As visualized by the following quotes, U*ser Experience* proved to be an important aspect during the development of digital tools:

"Well, if we talk about incorporating the user within the design that is of course the idea. We have multiple teams, like costumer experience where the experience of the costumer is central. Whenever we provide certain adjustments it goes through experience teams that perform a so-called acceptance-test to check if it is possible" (Appman).

"Well, the costumers that I serve are usually small- to medium sized MKB-firms. The big MKB-firms usually work together in teams with a separate UX-designer and a separate UI-designer. So, there is a big group of people that that discuss how something should be made" (Webdev).

"Well, you have the experience-guy that thinks about how the user can best handle the product. I do not know if you still have an old computer, but you should start up Windows XP or Windows 2000 just to see whatever approaches you when you use it. Compare that to a mobile phone, they have been growing the fastest, if you take one from 5 years ago and compare that with your current phone, that is a very big example of user experience" (Busapp).

"Well for instance during a migration-trajectory our focus was 100% aimed at the user's experience. I think in terms of client management that is your number 1 goal" (Wpman).

Thus, we observed that within the IT-sector there appeared to be a distinct function that focusses solely on the end-user. The UX-designer and UX-design were terms that were frequently mentioned among the designers that we have spoken to. In fact, we viewed the term *User Experience* to be the embodiment of our proposed *Technological Adaptivity* as it consists of the entire trajectory to make digital tools as adaptive towards it end-users as possible. We mention 'as possible' because we also observed restraining factors that were mentioned by the IT-designers. These factors influenced the adaptivity of a digital tool and could not be unaccounted for.

IT-DESIGN: RESTRAINING FACTORS

The IT-designers mentioned restraining factors in terms of technical boundaries, organizational restrictions, financial restrictions and interpersonal differences. As one can already see, these restrictions were similar to those that were mentioned by the end-users within our sample. Firstly, technical boundaries were depicted in the following quotes:

"It is important to remain critical about the feedback that you receive. Sometimes people just want something within an application but that will simply take too much from rest of the application" (Busapp).

"Well, it has to be realistic of course, a developer of course has to able to code within an application" (Appman).

"Well, whenever I've developed a website they always want more menu-items. But that will result in me having no more space for the mobile or tablet version" (Webdev).

Thus, the requests of an end-user were not always possible in terms of technical boundaries. What

seemed to be a small change in the eyes of an end-user was of large impact to for instance the underlying structure of an application. Moreover, some adjustments could technically not be implemented by designer in terms of for instance "coding-issues". Secondly, we heard similar voices as those of the end-users in terms of organizational and financial restrictions. The IT-designers acknowledged the role of organizational decision makers as well, whereas they focused more on the financial aspects and less on for instance organizational size. The latter was depicted within the following quotes:

"A business allocates a budget and therefore has a voice in what a digital tool should be used. They often ask to 'keep it within a certain budget'" (Appman).

"You then see it often just costs to much for an organization to replace that "one system that needs replacing" (Busapp).

"I have often had conversations with the board, but they often mention that certain changes have a cost tied to it. They said that it was cheaper to buy an entirely new system than to implement my suggested changes" (Wpman).

Hence, not only end-users experienced that organizations and their financial intentions play a role in the adaptiveness of a digital tool. It was a restraining factor for the designers as well. Lastly, we also heard voices about the interpersonal differences regarding the adaptivity of digital tools from the IT-designers within our sample. These interpersonal differences were depicted in the following quotes:

"*Well, when I design something I for instance look at characteristics like age to design something that the users within a specific age-group want. But also, gender plays a role and there are also aspects that are only attractive to certain super-nerds whereas other users will avoid them as much as possible" (Webdev).*

"The best way is to not make the most ideal thing for one user but the find a middle ground for what everybody wants. Else it will take years of course" (Busapp).

In addition, the IT-designers added that the end-users themselves also need to adjust in order for a digital tool to be optimized. The latter is depicted by the following quotes:

"On the one side the application needs to be adjusted to the user, but that does not mean that the user does not need to adjust as well.

"Users are used to work in a certain way, and they do not want to deviate from it. But you need to raise them to develop themselves, so that freedom to also like "raise" users how to use technology should be available" (Webdev).

"Well, you have to kind of steer the end-user as well because else the application itself becomes too simple. Then you would miss a lot of functionality in the end" (Busapp).

"Well, it is not only the technology itself, but also the way in how it is used. Sometimes just a small tip makes them work a lot more efficient" (Wpman).

Hence, the interpersonal differences do not only imply that end-users differ based on needs. They themselves also have to adjust because sometimes a new digital tool required them to learn how to use it. We did however already uncover that learning aspect during our analysis of the end-user perspectives. Thus, while the IT-designers put effort into creating digital tools that are adapted towards the end-users within their design-process, there are multiple factors that are of restraining influence. However, we observed the design-process itself is actually going in a novel and interesting direction.

IT-DESIGN: AN ADAPTIVE TREND

We observed that the design-process of digital tools was actually shifting compared to the past according to the IT-designer. The latter was depicted within the following quotes:

"Well, you see that a lot more focus now lies on the attractiveness and intuitiveness of applications. We have an increasing number of UX-designers that only deal with the experience that a user might have, what is the perfect flow, that sort of stuff" (Appman).

"Well, a lot is changing in the design process, they for instance design mobile-first now. The menu becomes more innovative and different, and that is mostly because they use User-data from Google Analytics" (Webdev).

"It is mostly upcoming and more dynamic. When you look back in the past and open an old system I think you can find the answer if the end-user is being considered more. User experience is mentioned more often, you can start to count how many designers are being involved" (Busapp).

"Well, if I look at the projects that originate from Germany I can see a lot of change, they really use your input. They absolutely listen more to users, on a scale of.. from zero to 10 at the moment. I think that listening to users while designing is becoming a trend" (Wpman).

Thus, IT-designers experienced and expected that *User Experience* within IT-design would increase in popularity in the upcoming years. The latter served as an interesting observation, because it implied that technologies would become even more adaptive towards their end-user before implementation, and thus before *Agency-conflicts* would arise.

DISCUSSION

The central question that we addressed in this study was: "*What are characteristics of technological adaptivity towards different user-generations in modern-day organizations"?*. We asked this question because of the rising importance of IT-technologies within organizations and the agency-conflicts that occur from the relationship with their end-users. In addition, we also incorporated the literature on digital generations & IT to account for the possible differences in technological interaction between the end-users. With that, we aimed to explore the possibilities of technology to adapt to its end-user and thereby detached from the original view of 'rigid-technologies' within agency theory

Firstly, we concluded that the presumed generational differences did not exist among the digi-generation in our sample, apart from minor anomalies. We observed a shared optimism about digital tools among the digi-generations. Furthermore, we observed no significant issues with digital tools as well as a similarity in demands and perspectives. Whereas the literature on digital generations & IT mentioned that this optimism would be more apparent within the *Digital Native*-generation and that these *Natives* would be more competent with the use of digital tools, we found that the *Digital Immigrants* were similar to the *Natives*. We tied this finding to the concept of *Learning & Affluence,* because both digi-generations had either learned to how use digital tools over time or already had adequate knowledge of IT in general either through growing up with them or having affluence towards them. Hence, we found that difficulties with digital tools were mainly applicable to general issues like internet connections and failing IT systems but not to the specific competency of the end-user. The latter meant that the *agency-conflicts* that we assumed to originate from the difference in technological skills based on generations of end-users were not apparent. Thus, synergies do appear to exist between the two digi-generations as was also mentioned within the studies of Waycott et al. (2010) and Eginli & Isik (2020). Therefore, our study adds the concept of *Learning & Affluence* to the existent theories on digital generations & IT which explains these similarities. Moreover, we also conclude that instead of age, the *agencies* of individuals (read: goals and needs) are factor that explains differences between generations in IT-usage which is in synergy with the similar claims of Parry (2017). Because of the differing experiences of individuals within and across generations of human beings, they each strive for different goals which also affects their technology-usage and affection.

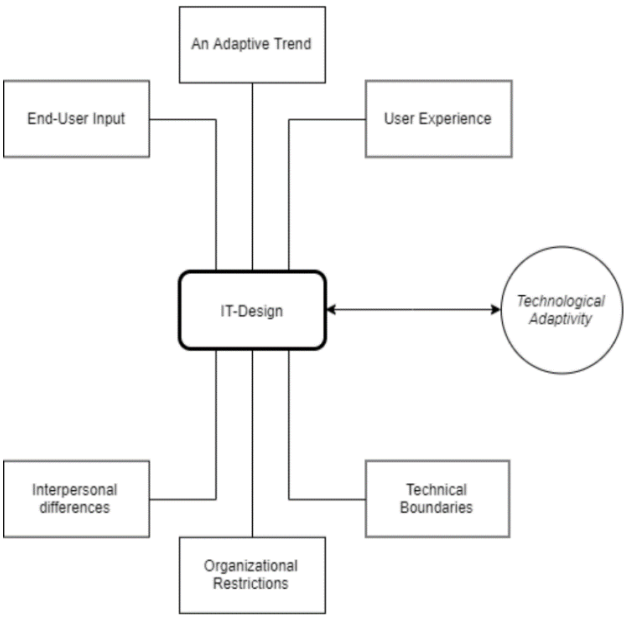
Secondly, we uncovered characteristics of *Technological Adaptivity* in terms of *End-User Input, User Experience* and an *Adaptive Trend* as well as restricting factors in terms of *Organizational-, financial-, interpersonal-* and *technical boundaries*. Throughout our research it became apparent that these characteristics were divisible in either being the product of the human-technology relationship or being an independent force on the creation of *adaptive technology.* Firstly, we observed that the main purpose of an IT-functionary is to optimize applications for the end-user and that these applications are being developed based on feedback. Thus, the *End-User's Demands* were considered within the development of a digital tool. However, these demands originated from the difficulties that these end-users faced while using digital tools and can therefore be seen as *Agency-conflicts.* These *Agency-conflicts* served as the basis for the feedback that caused technology to become more adaptive towards its user. In fact, Leonardi (2011) described this feedback-loop with his concept of *imbrication* within the theoretical framework of this paper. Therefore, we saw the *End-User Input* characteristic of *adaptive technology* as the product of the human-technology relationship that is created through the constant clashing of *human-* and *technological agencies*. The latter implied that the end-user was the initiator of the adaptivity within digital tools and thereby only confirmed the existent *agency-theory*. However, we the other two characteristics caused digital tools to adapt regardless of *Agency-conflicts* (read: the end-user's efforts) which made them more confirming toward the main purpose of this paper. After all, we aimed to explore if the digital tools themselves could be more adaptive and therefore avoid the *Agency-conflicts* that cause a loss in productivity and satisfaction in the first place.

These characteristics proved to be *User Experience* and *Adaptive Trend* that were experienced within the IT-sector. It became apparent that the importance of *User Experience* rose within the IT-sector which meant that the end-users of a certain digital tool were already visualized and incorporated during the development of a digital tool. The latter caused the tool in question to be tailored towards its end-users before it was

implemented. Hence, the IT-designers were trying to allow for a smooth implementation and 'fit' of the specific digital tool within a certain process. This focus on the end-user within IT-design was experienced by both the IT-designers during the development of digital tools and by the end-users that used them in their everyday job. Hence, digital tools were not as rigid as we assumed they would be, and we argued that that could lead to a reduction in *Agency-conflicts*. In addition, it became clear that the role of *User Experience* within IT-design was still upcoming and it was expected to become even more important within the future development of IT-design. It is interesting to see how this *Adaptive Trend* is going to influence the Human-IT relationship in the future, because the *Technological Agencies* (read: provided options by digital tools) are assumed to become more synergized with the *Human Agencies* which reduces the possibilities of *Agency-conflicts* to occur.

Lastly, we identified a couple of restricting factors as well. Organizations and their financial intentions served to be the most restricting on the adaptivity of a digital tool. Most often, the financial budget of a certain organization caused the IT-designers to be limited in their creativity during the development of a digital tool. Moreover, the size of an organization influenced how adaptive the tool in question could be, because a large organization could not afford to pay for a tool that was tailored to all of its individual departments. This caused the digital tool to be developed based on the generic need of the entire organization which reduces its adaptiveness. Apart from these organizational factors, we also observed technical boundaries. These boundaries simply implied that not everything can be 'coded' or crafted in a digital tool by an IT-professional. To conclude, the interpersonal differences among end-users made incorporating every specific need of an individual impossible. In order to clarify the latter, we merged the characteristics and restrictions into figure 1 which visualizes how our proposed *Technological adaptivity* assumingly functions within the relationship between digital tools and their end-users.

Figure 1: Framework for Technological Adaptivity



As one can see, the end-users played an active role through their *End-user Input* that influenced the IT-design. As we mentioned earlier, this process was similar to the concept of *imbrication* wherein the *Agency-conflicts* that arose through the interaction between end-users and digital tools caused digital tools to become more adaptive. What we found more notable, is that the IT-designers influenced the IT-design, and thus the *Technological Adaptivity* of certain digital tools, Independently of the end-user's input and/or effort. The importance of the *User Experience* function and the *Adaptive Trend* that were shifting the focus within IT-design towards the end-users of its products caused digital tools to be adaptive regardless of the end-users input. The latter implied that apart from the 'traditional' process of *Agency-conflicts* that shaped digital tools within their environment, a separate process that shaped digital tools also existed. These combined characteristics influenced the IT-design in such a way that the digital tools within work-environments were already experienced by the end-users as being tailored towards them and thus were causing *Technological Adaptivity* to occur. However, the IT-design process was also influenced by a number of restraining factors that influenced the possibilities within IT-design. This caused the *Technological Adaptivity* to not be fully optimized because the IT-design was limited in its possibilities. Finally, the interaction between IT-design and *Technological Adaptivity* is seen in this paper as a reciprocal process. The adaptive characteristics and restrictions cause adaptive digital tools to originate from IT-design, whereas the feedback from the resulting *Technological Adaptivity* flows back towards IT-design and causes further improvement under the same influence of those adaptive characteristics and restrictions.

CONCLUSION

It appeared that a distinct difference between the end-users of technology based on their generation did not exist, but that possibilities for digital tools to adapt to its end-users were available and already in play. We found that the digi-generations of our sample were not separatable from each other apart from minor anomalies which affirmed that a distinct difference between the digital generations of IT-

users is questionable. We uncovered that the differences between both digi-generations became diminishable through *learning and affluence* and that *agency*-theory actually explains differences in technology-usage among and within generations because of a difference in goals between individuals rather than a difference in age. We therefore added to the question of scholars to further investigate differences and similarities between the generations of IT-users. Furthermore, we uncovered that three characteristics, being the incorporation of *End-User's Input,* the importance of *User Experience* within the IT-sector and the expected *adaptive trend* within that sector are driving digital tools to become increasingly adaptive towards their end-users. The incorporation of the *End-User's Input* within IT-design proved to be a confirmation of the agency-theory wherein *Human-* and *Technological Agency's* clash and therefore cause digital tools to adjust based on their feedback. However, we also uncovered that digital tools are being tailored towards the end-user's before they are implemented. The latter meant that digital tools were not as rigid as we assumed them to be when they were introduced to a workforce and we observed that this will continue to evolve because of the increasing importance of *User Experience* within the IT-sector and the fact that this *adaptive trend* will likely continue in the future. The latter implied that *Agency-conflicts* and thus losses in productivity and work-satisfaction could reduce because we assume that the *Technological Agency* of digital tools will become increasingly synergized with the *Human Agency* of its end-users as this *adaptive trend* will continue. The presence of adaptive technological artifacts proved to be a phenomenon that was unaccounted for in the literature on agency and thus detaches from the original views that depicted technological artifacts as rigid and limited in their available options. It would be interesting to see where this novel view could take the agency-theory in the future.

LIMITATIONS AND AVENUES FOR FUTURE RESEARCH

As described in the conclusion of this paper, we would find it interesting to see how the relationship between end-users and technological artifacts could be affected due to the presence of adaptive technologies. Future research on the impact of *Technological Adaptivity* within the context of Agency- or sociomateriality theory could expand the scholarly streams leading to new insights on the relationship between technology and human end-users. After all, socio-materiality and agency theory imply that technological artifacts are shaped through their interaction with their end-users that face a limited set of options, but we uncovered that artifacts are not as rigid as scholars' depicted them to be. The consequences of these adaptive technological artifacts could possibly result in novel aspects to the human-technology relationship. Furthermore, we uncovered that the digi-generations in our sample were not as separatable as some scholars implied. We therefore answered to the question to investigate the generational similarities and differences further. We did uncover anomalies, being that *Digital Natives* prefer hardware and that *Digital Immigrants* want IT-systems to learn from them. Additional research could be done to uncover what exactly triggered these differing responses in order to further extend the theory on digital generations and IT in terms of specific differential factors between technology-users and their causes. Moreover, additional research could also be done on the effect of *Technological Adaptivity* on workforce-outcomes of organizations. We uncovered that the end-users in our sample experienced an increase in productivity and work-satisfaction. It would be valuable if there are more positive- and negative outcomes that result from adaptive technological tools within a work-environment. Lastly, the effects of our uncovered restrictions on the IT-design also need to be investigated to measure their exact impact on the degree of adaptivity within digital tools. In addition, possible ways to decrease these restrictive effects could also be uncovered to foster the degree of *Technological Adaptivity* within organizations.

Our study also has limitations. Firstly, we conducted 12 interviews that consisted of 8 end-user's and 4 IT-designers. It would be valuable to include more interviews with end-users from both digi-generations and designers to generate more data increase the accuracy and validity of our findings. Secondly, we chose to use the theory of agency as the scope in which the human-technology relationship was placed. However, different theories on human-technology interaction could have been used as well. This would have provided a different view in explaining human-technology interaction and could have led to different outcomes Third, we chose to use a data-collection method that consisted purely of interviews. Other methods like focus-group sessions or shadowing could also have been used which could lead to more in-depth insights as interviews are mostly a snapshot of reality.

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APPENDIX A: INTERVIEW PROTOCOL FOR THE USER OF DIGITAL TOOLS

Date: __-__-____
Time: __:__-__:__
Participants: **F.J. Stegehuis (Researcher and interviewer), _____ (function/acronym)**
Form: **Semi-structured**
Generation:

Introduction

- **Researcher and research goal**

Frank Stegehuis, Master student Business Administration at the University of Twente.

Research into the relationship between IT-applications and its end-users using both the theory of Agency and IT & Generations. The research was done in light of the "workplace of the future" that is predicted to be heavily depended on IT.

- Agency theory tells us how both user (with their specific goals and needs) and technology (with the options it provides) interact and often clash with each other.

- The research specifically focusses on the differences that exists among differing generations of end-users, like young workers (digital natives) that grew up with technology vs the older workers (Digital immigrants) that did not experience it in this way. *If one considers the fact that generations of humans will always follow each other up together with the rapid and evolving development of IT within businesses, its is fair to assume that the Digital Natives of today could actually become the Digital Immigrants of tomorrow.*

- This research assumes that technology has to become *adaptive* in order to avoid these "clashes" and foster both productivity, user satisfaction and to avoid future issues when the workplace becomes even more dependent on IT with regard to both user groups. We therefore think it is time to explore possibilities for digital tools to adapt to its end-users.

- **Anonymity and use of data**

Discuss with interviewee that; his/her name will not be mentioned, the interview will be recorded and transcribed (if agreed by interviewee), the transcript will be stored in a pass-word protected file and if possible can be reviewed by interviewee. The recording will be deleted after finalizing this research-assignment. The paper will be visible only for an HRM-professor of the University of Twente, and by the interviewee if this is a wanted option.

- **Time**
  The interview will take approximately 30 to 45 minutes and consists of 15 open-ended questions but needs to be an open discussion

- **Key insights**

Key insight 1: Digital tools must respond to the human agency of end-users in order to achieve optimal performance and satisfaction;

Key insight 2: The different technological backgrounds of generations are shaping the agencies of past and future workforces;

Key insight 3: Rigid and non-adaptive digital tools will continue to cause strong negative disruptive effects for organizations by not meeting their expectations.

Key insight 4: The options that digital tools provide through its technological agency need to be tailored to its end-users if organizations want to avoid the consequences of Agency-conflicts. **Introducing questions**

1.1 **Could you please introduce yourself (Function, profile, background).**

1.2 **Regarding your job, what are your goals/needs towards it?**

1.3 **Regarding your job, when do you need to use IT?**

2 The technological background (agency) of the user (key insight 2)

2.1 **This research is about the importance of IT-applications regarding one's work. How have you experienced this in your career/job? Example?**

2.2 **How do you experience IT-applications gaining more and more influence within organizations? Can you give an example?**

2.3 **When taking these goals and needs into account, can you explain what role IT- applications like for instance organizational systems, e-mail and call apps like zoom and skype played in your everyday job? Examples?**

2.4 **What do you think you need from the IT-applications that help you perform well in your job?**

2.5 **Do you feel that your goals and needs (agency) are considered when your organizations provide you with IT-applications? Can you give me examples?**.

2.6 **Do you feel that your goals and needs (agency) are considered when your organizations provide you with IT-applications? Can you give me examples?**

3 The user's interaction with IT. Mention new block! (now move towards the actual working with technology)

3.1 **How intensively do you need to use of IT-applications for your job.**
High, moderate or low?

3.2 **When u use IT-applications like a company system, database, e-mail or call application like Zoom or Teams, do you feel any restraints or difficulties regarding your productivity and or work satisfaction? How so? Can you provide an example?**

3.3 **When taking the last question in regard, do you also feel any advantages that these applications bring to you regarding your productivity and/or work satisfaction? Please elaborate.**

3.4 **When taking these advantages and restraints into account, what do you feel that you expect from the IT-applications that you use in your daily work-routine?**

3.5 **When taking these advantages and restraints into account, can you elaborate on how u specifically use the IT-applications in your daily work routine?**

3.6 **When taking the latter into account, in what way do you think that IT-applications can optimally serve you in your work routine?** ***Please think in ways of adjustments or alignment between the IT-application and your work routine.***

4. Adaptability of IT (USER).

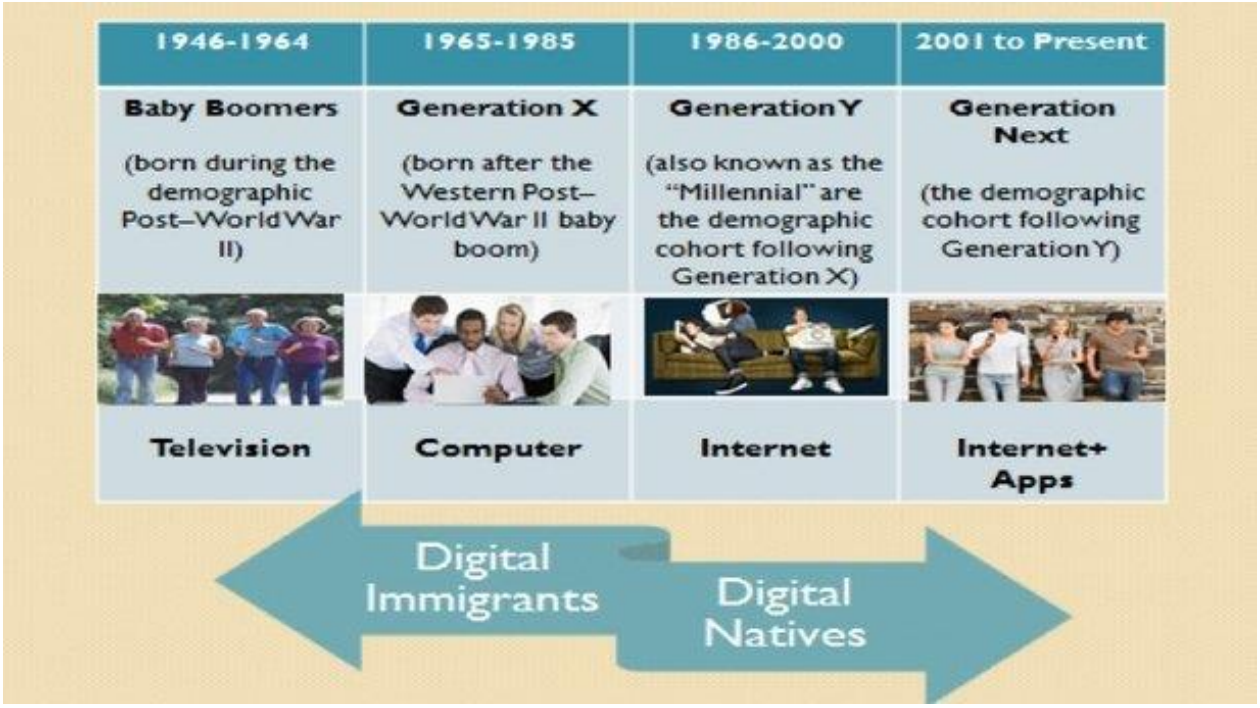
4.1 Do you share the thought that IT has to adapt to its end-users when it gains more influence? How so?

4.2 What needs to be changed in IT-applications? Why? Examples – why would it work better?

4.3 Final thoughts on the Technological adaptivity regarding your experience?

Finalizing

Thank interviewee for time and answers. Remind them if about anonymity, use of data and final product (master thesis). Moreover, ask if they want to validate the transcripts after they are finished. Transcript will be sent, time to reply is 1 week.



APPENDIX B: INTERVIEW PROTOCAL FOR THE DESIGNER OF DIGITAL TOOLS

Date: __-__-____
Time: __:__-__:__
Participants: **F.J. Stegehuis (Researcher and interviewer), _____ (interviewee)**
Form: **Semi-structured**
Generation:

Introduction

- **Researcher and research goal**

Frank Stegehuis, Master student Business Administration at the University of Twente.

Research into the relationship between IT-applications and its end-users using both the theory of Agency and IT & Generations. The research was done in light of the "workplace of the future" that is predicted to be heavily dependent on IT.

- Agency theory tells us how both user (with their specific goals and needs) and technology (with the options it provides) interact and often clash with each other.

- The research specifically focusses on the differences that exists among differing generations of end-users, like young workers (digital natives) that grew up with technology vs the older workers (Digital immigrants) that did not experience it in this way. *If one considers the fact that generations of humans will always follow each other up together with the rapid and evolving development of IT within businesses, its is fair to assume that the Digital Natives of today could actually become the Digital Immigrants of tomorrow.*

- This research assumes that technology has to become *adaptive* in order to avoid these "clashes" and foster both productivity, user satisfaction and to avoid future issues when the workplace becomes even more dependent on IT with regard to both user groups. We therefore think it is time to explore possibilities for digital tools to adapt to its end-users.

- **Anonymity and use of data**

Discuss with interviewee that; his/her name will not be mentioned, the interview will be recorded and transcribed (if agreed by interviewee), the transcript will be stored in a pass-word protected file and if possible can be reviewed by interviewee. The recording will be deleted after finalizing this thesis. The draft-paper will be visible for an HRM-professor of the University of Twente, and by the interviewee if this is a wanted option.

- **Time**
  The interview will take approximately 30 to 45 minutes and consists of 16 open-ended questions

- **Key insights**

Key insight 1: Digital tools must respond to the human agency of end-users in order to achieve optimal performance and satisfaction;

Key insight 2: The different technological backgrounds of generations are shaping the agencies of past and future workforces;

Key insight 3: Rigid and non-adaptive digital tools will continue to cause strong negative disruptive effects for organizations by not meeting their expectations

Key insight 4: The options that digital tools provide through its technological agency need to be tailored to its end-users if organizations want to avoid the consequences of Agency-conflicts.

Introducing questions

1.1 Could you please introduce yourself (Function, profile, background).

1.2 Regarding your job, what are your goals/needs towards it?

1.3 Regarding your job, when do you need to use IT?

2 The technological background (agency) of the user (key insight 2)

2.1 **This research is about the importance of IT-applications regarding one's work. How have you experienced this in your career/job? Example?**

2.2 **How do you experience IT-applications gaining more and more influence within organizations? Can you give an example?**

2.3 **When taking these goals and needs into account, can you explain what role IT- applications like for instance organizational systems, e-mail and call apps like zoom and skype played in your every day job? Examples?**

2.4 **What do you think you need from the IT-applications that help you perform well? And what do you think end-users needs?**

2.5 **How are work goals and needs considered when designing an IT-applications? Can you provide an example? To what extend is the design-process customized towards these goals?**

3 The user's interaction with IT (mention this block, moving towards actual working with IT)

3.1 How intensively do you need to use of IT-applications for your job. *High, moderate or low?*

3.2 When u use IT-applications like a company system, database, e-mail or call application like Zoom or Teams, do you feel any restraints regarding your productivity and or work satisfaction? How so?

3.3 When taking the last question in regard, do you also feel any advantages that these applications bring to you regarding your productivity and/or work satisfaction? Please elaborate.

3.4 When taking these advantages and restraints into account, what do you feel that you expect from the IT-applications that you use in your daily work-routine?

3.5 When taking these advantages and restraints into account, can you elaborate on how you then specifically use the IT-applications in your daily work routine?

3.6 When taking the latter into account, in what way do you think that IT-applications can optimally serve you in your work routine? Please think in ways of adjustments or alignment between the IT-application and your work routine?

4. Adaptability of IT (USER).

4.1 Do you share the thought that IT must adapt to its end-users when it gains more influence? How so?

4.2 What needs to be changed in IT-applications? Why? Examples – why would it work better?

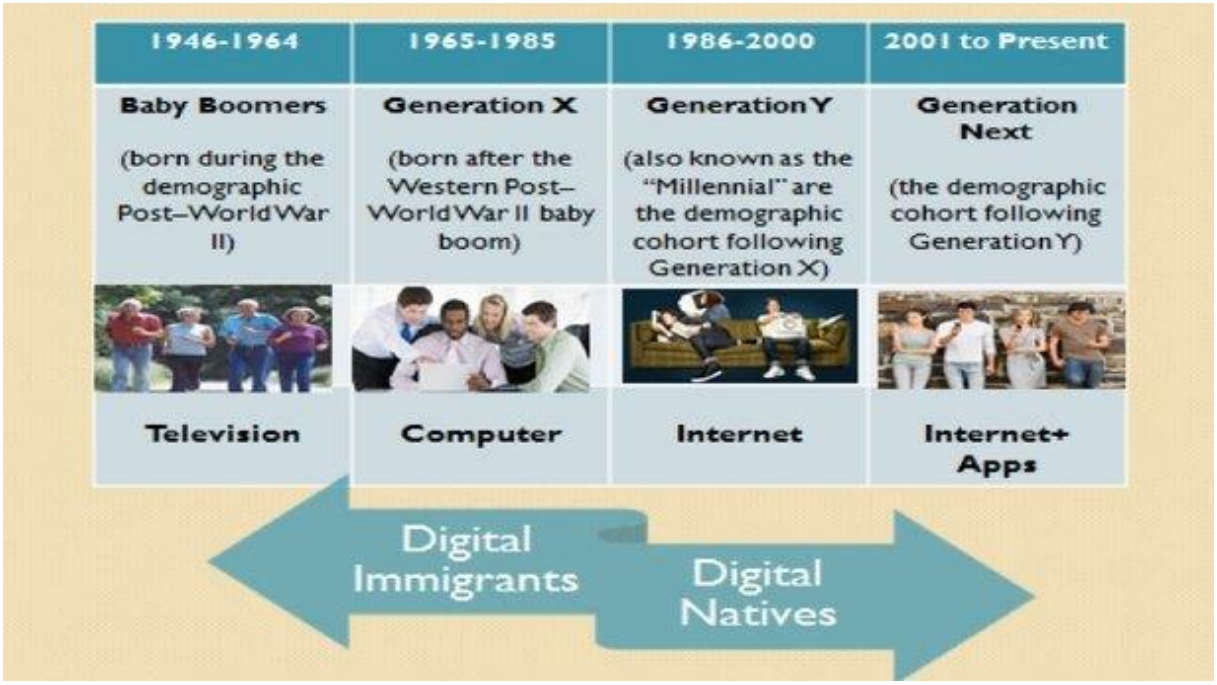
4.4 Can you share some experiences about user feedback regarding one of the IT-applications that you created or manage(d)?

4.3 Have you experienced any changes/differences related to the design process of IT-applications considering your work experience? Can you provide examples? Has it become more dynamic?

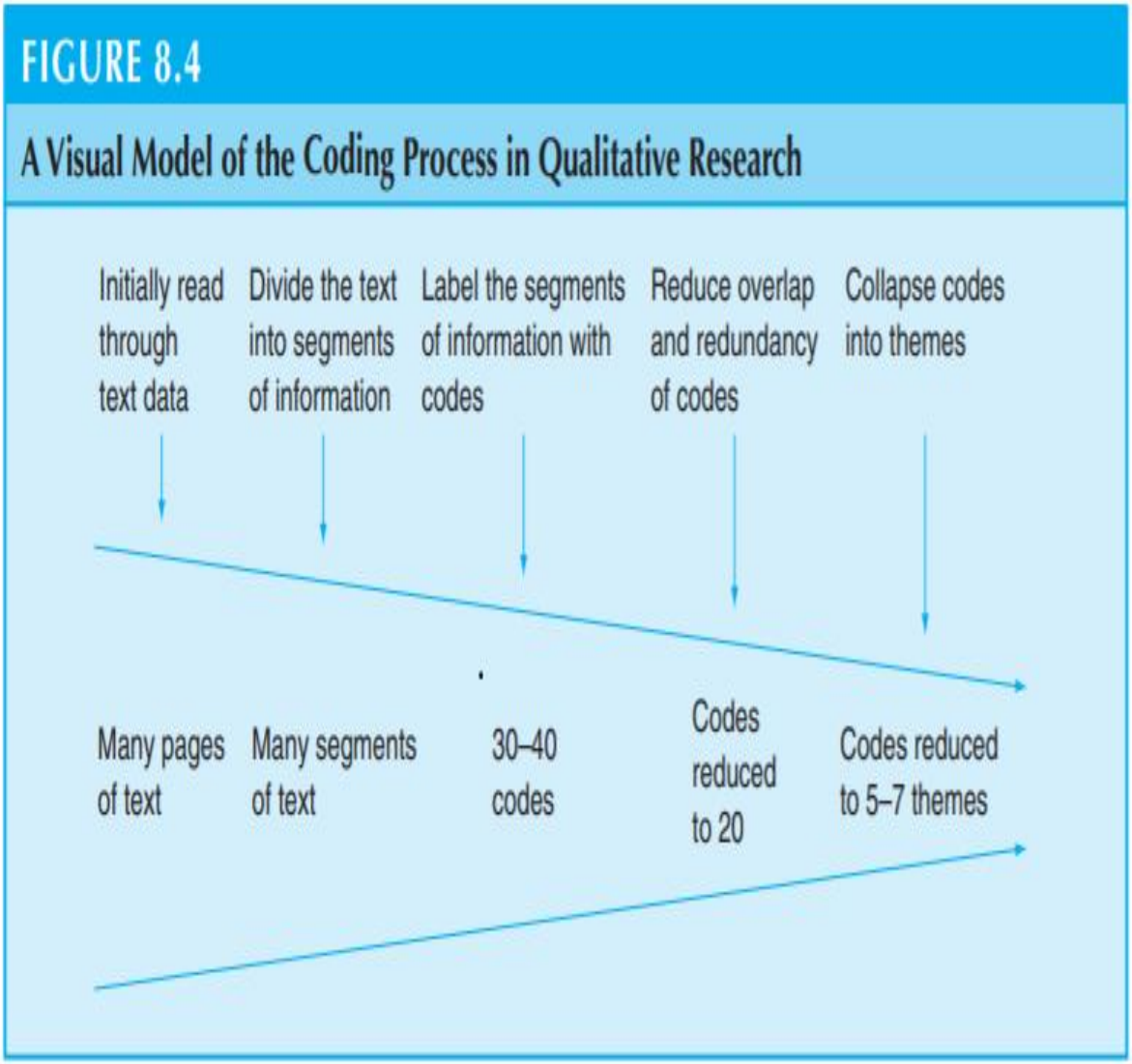
4.5 Final thoughts on the Technological adaptivity regarding your experience?

Finalizing

Thank interviewee for time and answers. Remind them if about anonymity, use of data and final product (master thesis). Moreover, ask if they want to validate the transcripts after they are finished. Transcript will be sent, time to reply is 1 week. Ask them were they fit in the picture below



APPENDIX C: DATA ANALYSIS STRATEGY (CRESWELL, 2002, P. 244)



APPENDIX D: CODE-DOCUMENT TABLES PER CODE GROUP

END-USER AGENCIES

Codes	Transcript NURSE DI Gr=115	Transcript POLICE DI Gr=84	Transcript SALESSUP DI Gr=73	Transcript ANALYTIC DI Gr=80	Transcript SUPPLY DN Gr=77	Transcript SPEAKER DN Gr=70	Transcript FINAD DN Gr=76	Transcript UN-ASSIST DN Gr=89
o Favoring personal communication over digital communication Gr=5	1	0	2	0	0	0	0	0
o Having good IT support Gr=7	0	0	1	0	4	2	0	0
o Having pure work-related goals Gr=9	1	2	1	1	1	1	0	0
o Having pure work-related needs Gr=4	1	1	1	0	0	0	0	0
o IT enforcing one's goals Gr=15	0	1	1	1	2	3	2	1
o Personal growth goals Gr=15	0	0	1	0	2	1	3	3
o personal needs Gr=12	0	0	0	2	0	1	2	2
Totals	6	4	7	4	9	8	9	6

END-USER DEMANDS

Open-codes	Transcript NURSE DI Gr=115	Transcript POLICE DI Gr=84	Transcript SALESSUP DI Gr=73	Transcript ANALYTIC DI Gr=80	Transcript SPEAKER DN Gr=77	Transcript FINAD DN	Transcript SUPPLY DN	Transcript UN-ASSIST DN Gr=89
o Demanding accessability and performance from IT Gr=45	8	9	4	10	2	4	4	5
o Demanding extra options apart from "basic" options Gr=2	0	1	0	0	0	0	0	0
o Demanding good hardware Gr=12	0	0	0	0	1	0	3	1
o Demanding intuitivity from IT Gr=70	17	5	2	12	9	4	4	6
o Demanding synergy and overlap between applications Gr=28	1	5	0	9	3	1	2	5
o Demanding that IT-applications automize tasks Gr=4	0	1	0	0	1	0	1	0
o Demanding that IT-applications communicate with the user Gr=27	0	3	4	7	1	3	4	5
o Demanding that IT-applications learn from the user Gr=15	0	1	4	6	0	0	2	0
o Personalizing an IT app Gr=17	0	0	3	0	0	0	0	5
Totals	26	25	17	44	17	12	20	27

END USER INTERACTIONS

Open codes	Transcript NURSE DI Gr=115	Transcript POLICE DI Gr=84	Transcript ANALYTIC DI Gr=70	Transcript SALESSUP DI Gr=76	Transcript SUPPLY DN Gr=77	Transcript SPEAKER DN Gr=80	Transcript FINAD DN Gr=73	Transcript UN-ASSIST DN Gr=89
o Able to store/save information Gr=12	0	0	0	2	0	2	0	2
o Able to work independent of location Gr=19	0	3	0	6	1	0	0	5
o Adequate knowledge/experience Gr=20	0	4	3	0	2	1	4	0
o Authorizational issues Gr=6	1	1	0	0	3	0	0	0
o Being able to visualize data Gr=13	0	5	1	1	0	4	0	0
o Being less quick than others Gr=2	2	0	0	0	0	0	0	0
o Growing up with IT Gr=11	3	1	0	0	0	1	1	0
o Change in work-routine due to IT Gr=13	6	1	0	0	1	0	0	0
o Dependency of internet connection Gr=22	0	3	4	4	1	1	4	2
o Difference in knowledge among users Gr=33	0	4	0	0	4	2	5	4
o Experiencing an overload of Information Gr=18	1	0	2	0	0	5	4	1
o Experiencing difficulty with IT Gr=19	14	0	0	1	1	0	2	1
o Experiencing inefficiency due to IT Gr=20	4	0	1	0	1	0	0	2
o Experiencing intuitivity within IT Gr=6	0	0	0	0	0	2	0	4
o Experiencing IT as supporting in one's job Gr=52	4	6	7	6	6	7	3	3
o Experiencing slow adaptiveness regarding IT Gr=3	2	0	0	0	0	0	0	0
o Failing IT system Gr=15	2	1	4	0	0	1	1	2
o Forced to use IT Gr=22	3	1	1	1	1	2	2	4
o Having afluence with IT Gr=8	0	3	0	2	2	0	0	0
o Having to learn how to work with IT Gr=38	11	4	1	1	4	1	3	4
o Having to perform unnecessary steps Gr=22	5	4	1	0	1	4	0	3
o Increased workload due to IT Gr=6	3	0	0	0	0	0	0	0
o IT empowering communication Gr=29	0	1	0	9	0	1	0	5
o IT lacking specialization to certain users Gr=6	2	3	0	0	0	1	0	0
o IT reducing errors Gr=8	0	0	0	0	4	1	2	0
o IT simplifying work Gr=4	0	0	1	0	0	1	0	1
o Less difficulty due to experience/afluency Gr=4	0	3	0	0	0	0	0	0
o Loss of non-verbal cues due to IT-communication Gr=3	0	0	0	2	0	0	0	0
o Lost time due to increased administration Gr=3	0	0	0	0	0	0	0	0
o Not being able to fix the IT problem Gr=6	4	0	0	0	0	0	2	0
o Outdated IT systems Gr=9	0	0	1	0	0	2	1	0
o Overload of IT-applications Gr=16	0	0	0	0	3	3	2	1
o Perceiving difference in IT-afluence Gr=17	0	2	0	1	3	1	0	0
o Perceiving other generations to be more skilled with IT Gr=9	6	0	0	0	0	2	0	0
o Perceiving same generation to experience difficulty Gr=10	9	1	0	0	0	0	0	0
o Positive view on IT influence Gr=46	5	1	4	8	3	2	2	5
o Quick and easy access to Information Gr=29	5	3	1	5	0	5	0	0
o Working more effectively due to IT Gr=20	4	4	0	1	0	2	3	1
o Working more efficient due to IT Gr=61	8	5	4	2	4	4	3	5
Totals	104	64	36	52	45	58	44	55

END- USER PERSPECTIVES

Open codes	Transcript NURSE DI Gr=115	Transcript POLICE DI Gr=84	Transcript ANALYTIC DI Gr=70	Transcript SALESSUP DI Gr=76	Transcript SUPPLY DN Gr=77	Transcript SPEAKER DN Gr=80	Transcript FINAD DN Gr=73	Transcript UN-ASSIST DN Gr=89
o Acknowledging the need for adaptive IT Gr=28	1	0	1	3	2	6	1	3
o Encorporating the user within IT design Gr=62	0	0	0	1	6	6	0	0
o Experiencing IT adapting Gr=33	0	2	5	2	4	3	0	3
o Experiencing IT evolving Gr=36	2	4	4	4	6	2	1	2
o Financial restrictions on IT adaptivity Gr=9	0	1	0	0	0	1	1	2
o Having to keep up with the pace of IT Gr=15	4	0	0	0	0	0	3	0
o Interpersonal differences regarding IT adaption Gr=39	2	2	2	1	6	3	2	3
o IT-functionaries asking for user needs Gr=31	0	5	2	2	2	1	0	0
o Organizational restrictions on IT adaption Gr=26	3	5	0	1	1	1	2	5
Totals	12	19	14	14	27	23	10	18

IT-DESIGNER PERSPECTIVES

Open codes	Transcript APPMAN Gr=125	Transcript WEBDEV Gr=83	Transcript BUSAPP Gr=94	Transcript WPMAN Gr=86
o A change in design process Gr=8	2	1	3	2
o Connecting IT-applications Gr=6	0	0	1	5
o Developing IT-applications based on feedback Gr=39	11	11	10	17
o Difference in knowledge among users Gr=33	3	2	5	4
o Expecting an adaptive trend Gr=17	0	3	1	3
o Financial restrictions on IT adaptivity Gr=9	2	0	1	1
o Interpersonal differences regarding IT adaption Gr=39	0	11	6	1
o Optimizing Intuitivity within IT-applications Gr=24	8	3	6	5
o Organizational restrictions on IT adaption Gr=26	2	0	1	5
o Recognizing UX importance within IT Gr=27	11	2	5	5
o Shift in IT towards UX Gr=11	2	1	5	3
o Supporting the IT-user Gr=23	11	5	1	4
o Tailoring IT towards a certain business/audience Gr=22	1	7	5	2
o Technical boundaries on IT-adaption Gr=6	3	1	2	0
o User's need to adjust/learn Gr=13	6	1	1	5
o Working to improve and/or optimize Gr=49	23	3	8	15
Totals	85	51	61	77