Reconsidering the Socio-Technical Perspective under the Sway of Technological Individualization in Knowledge Work Settings

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PROLOGUE

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Enjoy!

Louise Harder Fischer

CONTENTS

List of figures

List of tables

List of appendix

Resume

Planlægning og forklaring af socio-tekniske ændringer og resultater i den digitale verden af vidensarbejdere er blevet stadig vanskeligere. Nogle af disse vanskeligheder opstår på grund af arbejdets skiftende karakter, nyskabende teknologisk udvikling og brug samt det stærkt konkurrenceprægede klima, hvor organisationer løbende lancerer forandring for at konkurrere og overleve.

Et centralt spørgsmål i forskningen i informationssystemer (IS) er, hvordan man forbedrer vidensarbejde i organisatoriske strukturer understøttet af informationsteknologi. IS-forskning handler især om at forstå og forklare, hvordan man designer, planlægger og styrer forandringer af effektive informationssystemer. En fælles overbevisning er, at et velfungerende IS stammer fra det omhyggeligt arrangerede forhold mellem forskellige komponenter, der udgør IS'et. Disse komponenter er information, mennesker, processer, teknologi og strukturer.

En bestemt måde at se på eller opfatte IS og dets komponenter er det socio-tekniske perspektiv. Det socio-tekniske perspektiv fremhæver de indbyrdes afhængigheder og uløselige forbindelser mellem et socialt undersystem og et teknisk undersystem. Perspektivet indeholder visse antagelser om forholdet mellem det sociale og det tekniske; og hvordan de sammen giver mulighed for produktive resultater. Med et socio-teknisk perspektiv ligger fokus på en gruppe brugere, der deler samme arbejdsopgave, teknologi og arbejdsforhold. Denne gruppe vil over tid udføre arbejdet på samordnede måder og dele de samme opfattelser af adfærd og teknologibrug. En antagelse er derfor, at et effektivt socio-teknisk system eksisterer i en ligevægt, der skaber strukturer og rutiner indlejret i organisationen. Perspektivet er således baseret på en tro på, at et socio-teknisk system etablerer institutionelle forskrifter og sociale normer omkring arbejdet. Men disse antagelser om, hvordan man etablerer et effektivt socio-teknisk system, der producerer produktive resultater, holder ikke længere. Globalisering, digitalisering og individualisering er nogle af de stærke drivkræfter i samfundet, der har transformativ indvirkning på arbejdspladsen. Vidensarbejdet er blevet mere og mere virtuelt, ikke-rutinemæssigt og autonomt, ligesom organisationen er blevet mere digitaliseret, decentraliseret og standardiseret. I denne verden kæmper virksomheder og IS-ledere med at producere produktive resultater fra deres it-implementeringer. Denne afhandling bidrager til udviklingen af et socio-teknisk forandringsperspektiv, der er levedygtigt og nyttigt på den moderne videns-arbejdsplads.

Vi gennemførte tre kritiske casestudier, hvor 48 vidensarbejdere, der arbejder på globale og virtuelle arbejdspladser, deltog. Vores udgangspunkt var et kritisk case study, hvor vi zoomede ind på brugen af sociale, mobile og skybaserede teknologier (SMC-teknologier) i form af Unified Communication and Collaboration (UCC) til støtte for ikke-rutinemæssigt kognitivt arbejde. UCC er et ensemble af kommunikations- og samarbejdsprogrammer, som kan formes af slutbrugerne; det er frivilligt og nemt at bruge.

Vores resultater viste, at vidensmedarbejdere i globale og virtuelle miljøer reagerer og interagerer anderledes med SMC i forhold til den traditionelle skildring i det socio-tekniske perspektiv. Vi observerede, at SMC giver mulighed for individuelle praksisser, hvori der udøves en høj grad af individuel autonomi. Vi observerede, at den enkelte bruger foretog selvorienterede valg med hensyn til arbejdspraksis baseret på muligheder for individuel produktivitet og nye effektive videndelingsmuligheder. Vi observerede, at SMC-teknologien var overraskende slutbruger-formbar.

For at forklare, hvorfor disse resultater opstod, tog vi en kritisk realistisk (KR) tilgang. KR betegner en tilgang, hvor den virkelige verden består af generative mekanismer, ikke kun empiriske fænomener. En generativ mekanisme er en trans-empirisk reel eksisterende enhed, der forklarer, hvorfor observerbare hændelser opstår. Denne tilgang gav mulighed for at konkludere, at det socio-tekniske perspektiv forudsætter, at et socio-teknisk system i ligevægt er et mest sandsynligt resultat af mekanismerne teknologisk institutionalisering og teknologisk socialisering. Vi fandt imidlertid individuelle, hurtigt skiftende resultater fra brugen af SMC-teknologi og viste en mulig kraftig indflydelse fra teknologisk individualisering, der ikke er medtaget i det socio-tekniske perspektiv.

Derfor foreslår vi nu, at et socio-teknisk perspektiv også skal involvere de produktive resultater, der skyldes mekanismen teknologisk individualisering. Teknologisk individualisering kan bedst forklares ved de mønstre vi observerede: Brugere tager kontrol over tid, tempo og informationsstrømme, da der ingen institutionelle forskrifter er i SMC-teknologien. Nye, individuelle og innovative arbejdsmetoder med SMC-teknologi opstår hurtigt. og udvikler sig konstant. Sociale relationer og organisationsstrukturer reorganiseres, og brugerne samles i flydende, personlige, virtuelle netværk. De opholder sig ikke længere i faste grupper dikteret af fysisk placering. Adfærden er orienteret mod individuel produktivitet.

Vi fandt, at de nye organisatoriske strukturer, der opstår i det interaktive forhold mellem enkeltpersoner med formbare teknologier, ikke hviler i stabil ligevægt. De hviler i ustabile formationer af netværksstrukturer.

Samtidigt og som antaget i det oprindelige socio-tekniske perspektiv trigges mekanismerne for institutionalisering og socialisering af andre virksomhedssystemer. Disse igangsætter en meget langsommere ændringssekvens, der fører til dybe strukturer og rutiner, der hviler i en kvasi-stabil ligevægt.

Drevet af vigtigheden af adgang til og kontrol med data og information i realtid af høj kvalitet involverer den enkelte sig i at producere praktiske og produktive resultater. Også ved at underlægge sig faste arbejdsprocesser og datastandarder fra virksomhedssystemer og platforme.

Vi foreslår nu, at det socio-tekniske forandringsperspektiv skal dække det, vi kalder for et ligevægtsparadoks. Ligevægts-paradokset skyldes den samtidige eksistens af socio-tekniske strukturer i kvasi-ligevægt og individuelle-tekniske strukturer i ustabil ligevægt. Vi bruger begrebet dobbelt-strukturer. I disse dobbelt-strukturer finder vi et adfærdsmønster, hvor dagligdags autonomi organiseres af den enkelte vidensarbejder, der hele tiden genvinder en ligevægtsbalance ved at maksimere og minimere autonomi i ønsket om produktivitet. Vi foreslår derfor en udvidelse af begrebet autonomi, der tydeligvis forandres under indflydelsen fra teknologisk individualisering.

Selvom de nævnte mekanismer i princippet er modstridende, så arbejdede de ikke mod hinanden. De supplerer hinanden og skaber, hvad vi kalder for et dualt IS. Det duale-IS ændrer væsentligt på, hvordan vi forklarer socio-tekniske forandringer. Det duale-IS indeholder nu både/og-tilgange. Det kan ses i den dynamiske relation mellem det individuelle individ, der er udstyret med SMC-teknologi på overfladeniveauet af strukturerne og det samme individ, også socialt orienteret, der interagerer med teknologi, der udgør processer og rutiner på det dybe niveau af strukturer. Når denne bevægelse er i gang, kombineres disse mekanismer og skaber samtidige produktive resultater. Vi foreslår begrebet modstridende komplementaritet til at forklare de dobbelte mekanismer, der forårsager resultaterne i det duale-IS. Vi introducerer dobbeltmekanismer i det socio-tekniske perspektiv, som nu potentielt kan levere humanistiske og økonomiske resultater, når teknologisk individualisering, teknologisk institutionalisering og teknologisk socialisering kombinerer og styrker hinanden. Men, hvordan man udløser denne form for mekanisme, kræver yderligere forskning.

Vi ser tendenser, der skaber resultater af både stabilitet i processer, der udgør dybere strukturer; og fleksibilitet i praksis, som udgør fleksible og formbare overfladestrukturer. Vi antager, at et system, hvor disse mekanismer udløses, kan være både modstandsdygtigt og elastisk.

Hvis en eller den anden mekanisme er for fremtrædende, kan systemet blive enten for stift eller løst og dermed falde ud af ligevægtsbalancen. En konsekvens er en spiral, hvor folk bliver egoistiske og udnytter ressourcer på vegne af andre. En anden konsekvens er, at systemet bliver overvældende stramt og stift og dermed vanskeligt at ændre. I begge disse scenarier vil opnåelse af både økonomiske mål og medarbejdertilfredshed være umuligt.

Begge disse scenarier findes på den moderne arbejdsplads i dag. De repræsenterer en reel og nuværende udfordring for ledere og enkeltpersoner på arbejdspladser, hvor disse bevægelser er i gang.

I lyset af disse udfordringer og muligheder bliver det socio-tekniske perspektivs oprindelige mission om at holde en ligevægt mellem mennesker og teknologi i stræben efter humanistiske og økonomiske mål et princip til efterlevelse. Et nyt perspektiv, der har lige fokus på balancen mellem individualisering, institutionalisering og socialisering, bliver vigtigt. Vi foreslår derfor, at virksomheder og IS-ledere skal være mere opmærksomme på, hvad der udløser individualisering, institutionalisering og socialisering på arbejdspladsen.

Hvordan vi planlægger og styrer IS-aktiviteter og tilpasser vores perspektiv til det duale-IS er vanskeligt. Derfor har vi udviklet en socio-teknisk forandringsforståelsesmodel, et aide-memoire, der kan understøtte IS-diskussioner i det nu duale-IS. Hertil stiller vi et sæt af hjælpe-spørgsmål, som IS-ledere kan diskutere.

Vi foreslår, at fremsynede arbejdspladser skal sigte på at fremhæve data og information som en fælles ressource, samtidig med at de sørger for individuel autonomi. Dette kan muligvis levere både økonomiske og humanistiske resultater. Dette kræver mere viden om, hvordan man udløser dobbeltmekanismen korrekt uden at forårsage nedbrud. Dette vil betyde en yderligere undersøgelse af begrebet data og information som en fælles ressource.

Abstract

Planning and explaining socio-technical change and outcomes in the digital world of knowledge work has become increasingly difficult. Some of these difficulties arise because of the changing nature of work, innovative technological development and usage as well as the highly competitive climate in which organizations constantly launch change to compete and survive.

A central issue in Information Systems (IS) Research is how to improve knowledge work in organizational structures enabled by information technology. In particular, IS research is concerned with understanding and explaining how to design, plan and manage change in efficient information systems. A common belief is that a well-functioning IS arises from the carefully arranged relationship between distinct components constituting the IS. These components are information, people, processes, technology and structures.

A certain way of looking at or perceiving the IS and its components is *the socio-technical perspective*. The socio-technical perspective highlights the interdependence and inextricable linkages between a social sub-system and a technical sub-system. The perspective holds certain assumptions around the relationship between the social and the technical; and how they in conjunction enable productive outcomes. Holding a socio-technical perspective, your focus as a researcher is on a group of users that shares the same work task, technology and conditions. This group will, over time, perform work in concerted ways and share the same perceptions of behavior and technology usage. Consequently, an assumption is that an efficient socio-technical system exists in an equilibrium, constituting structures and routines embedded in the organization. The perspective thus relies on a belief that a socio-technical system establishes institutional prescriptions and social norms around work. However, these assumptions on how to establish a socio-technical system that produces productive outcomes no longer holds. Globalization, digitalization and individualization are some of the forceful drivers in society that have a transformative impact on the workplace. Knowledge work in itself has become increasingly virtual, non-routine and autonomous, likewise has the organization become more digitized, decentralized and standardized. In this world of work, business and IS managers struggle to produce productive outcomes from their IT implementations. This thesis contributes to the development of a socio-technical change perspective that is viable and useful in the contemporary workplace.

We conducted three critical case studies, in which 48 knowledge professionals, working in global and virtual workplaces, participated. Our point of departure was a critical case study, where we zoomed in on *the usage of* social, mobile and cloud technologies (SMC technologies), in the form of Unified Communication and Collaboration (UCC) in support of non-routine cognitive work. UCC is an ensemble of communication and collaboration applications that are end-user malleable, voluntarily adopted and easy to use.

Our findings showed that knowledge professionals in global and virtual settings respond and interact differently with SMC as opposed to their traditional portrayal in the socio-technical perspective. Especially when engaging with SMC technology. We observed that SMC affords possibilities for individuate practices, exerting a high degree of individual autonomy. We observed that the individual user makes self-oriented choices in regards to work practices based on affordances of individual productivity and new effective knowledge-sharing possibilities. We observed that SMC technology was surprisingly end-user malleable.

To explain why these outcomes occurred, we took a critical realist (CR) approach. CR denotes a view in which the real world consists of generative mechanisms, not solely empirical phenomena. A generative mechanism is a trans-empirical real existing entity that explains why observable events occur. This approach gave an opportunity to infer that the socio-technical perspective assumes that a socio-technical system in equilibrium is most likely an outcome caused by the mechanisms of technological institutionalization and technological socialization. However, we found individual, fast-changing outcomes from the use of SMC technology and surmised a possible forceful influence from technological individualization not included in the socio-technical perspective.

Thus, we now propose that a socio-technical perspective must also involve the productive outcomes caused by the mechanism of technological individualization. *Technological individualization* can best be explained by the observable events: users take control of time, pace and information streams, no institutional prescriptions emerge from SMC technologies. New, individual and innovative practices with SMC technology emerge; and they evolve constantly. Relations and organizational structures are re-arranged, and users organize fluently around personal virtual networks instead of fixed groups and physical locations. The behaviors are oriented towards individual productivity.

The new organizational structures emerging from the interactive relationship between individuals with end-user malleable technology do not rest in stable equilibrium, they are unstable formations of network structures. However, as assumed in the original socio-technical perspective, the mechanisms of institutionalization and socialization are triggered simultaneously by more fixed enterprise systems that set in motion a much slower sequence of change, leading to deep

structures and routines resting in quasi-stable equilibrium. Driven by the importance of access and control of real-time, high-quality data and information, the individual, in producing practical and productive outcomes, also engages in workflows, business processes and data input standards from fixed enterprise systems and platforms. We now suggest that the socio-technical change perspective must cover what we label an equilibrium paradox, emerging from the simultaneous existence of socio-technical structures in quasi-equilibrium and individual-technical-structures in unstable equilibrium. We refer to this as dual-structures.

We now suggest an elaboration of the concept of autonomy under the influence of technological individualization, in which autonomy, on a daily basis, is organized by the individual knowledge worker, who reigns over an equilibration process of maximizing and minimizing autonomy in a pursuit of productivity.

As such, the mechanisms are not working against each other. They complement each other and create what we label the dual-IS. The *dual-IS* significantly alters how we explain socio-technical change. It now includes a *both/and* view in the form of the dynamic relation between the individuated individual empowered with SMC technology at the surface level and, the same individual being socially oriented, when interacting with technology constituting processes and routines at the deep level of structures. When triggered, these mechanisms and outcomes combine and work in tandem simultaneously. We propose the concept of contradictory complementarity to explain the dual-mechanisms causing the outcomes in a dual-IS. We introduce dual-mechanisms into the socio-technical perspective that can now potentially deliver humanistic and economic objectives when technological individualization, technological institutionalization and technological socialization combine and enable each other. However, how to trigger this form of mechanism needs further research. We see tendencies in the IS that create outcomes of *both* stability in processes constituting deeper structures *and* agility in practices constituting flexible and malleable surface structures. We surmise that a system, in which these mechanisms are triggered, can hold capabilities of resilience and elasticity.

As observed in some of our cases, if one or the other mechanism takes prominence, the system can become *either* too rigid *or* to loose, thus falling out of equilibrium conditions. One consequence is a spiral in which people become egoistic, exploiting resources on behalf of others. Another consequence is that the system becomes overwhelmingly strict and rigid and thus difficult to change. In any of these scenarios, achieving both financial objectives and employee satisfaction will be impossible.

Both of these scenarios are found in the contemporary workplace today. They represent a real and present challenge to managers and individuals in workplaces in which these forces are set in motion.

In the light of these challenges and opportunities, the socio-technical perspective's original mission, holding an equal balance between people and technology in the pursuit of humanistic and economic objectives, becomes a guiding principle. However, a new perspective must cover an equal focus on the balance between the outcomes from individualization, institutionalization and socialization. Lastly, we suggest that business and IS managers must be more aware of what triggers individualization, institutionalization and socialization.

How we plan and manage IS activities and adjust our perspective to the dual-IS becomes important. Thus, we deliver a socio-technical change framework, an aide-memoire, that can support the IS discussions in the now dual-IS. In addition, we suggest a set of questions that IS business managers could discuss. We suggest that the 21st century enterprise should aim at highlighting data and information as a shared resource, while simultaneously catering to the individuated individual's autonomy. In turn, this can deliver on economic and humanistic objectives. This involves more knowledge of how to trigger the dual-mechanism properly without causing breakdowns, eventually involving further examination of the concept of data and information conceptualized as a commons.

1. INTRODUCTION AND MOTIVATION

The way knowledge professionals work and the conditions of knowledge work have undergone vast changes over the past 30 years. The main drivers in this change are ascribed globalization and digitalization (Carnoy & Castells, 2001). Increased de-regulation of trade in the 1990ies (Carnoy & Castells, 2001) and the advents of information and communication technology (ICT) with increased processing power and network connectivity (Malone & Rockart, 1991) have had an immense influence on knowledge work and its importance for firms in the fast-changing and accelerating competitive climate (Nonaka & Takeuchi, 1995). De-centralization of the former hierarchical structures, more mutual coordination between members of the organization and a rise in non-routine cognitive jobs account for some of the main changes (Carnoy & Castells, 2001). In the late 1990ies, knowledge professionals and knowledge creation had become one of the most important assets in many global enterprises (Nonaka & Takeuchi, 1995). With the rising number of knowledge professionals in developed economies, Peter F. Drucker addressed the issue of productivity in knowledge work as one of the biggest challenges in the 21st century (Drucker, 1999). He promoted the idea that productivity in knowledge work does not lend itself to traditional productivity enhancers from the production line paradigm. He proclaimed that knowledge workers needed to have autonomy to be productive, innovative and to learn. *Autonomy* in the sense of freedom and discretion (Hackman, 1998) and opportunities to structure and control when and how to do the jobs (Spector, 1986).

The advent of new mobile and connectivity technology meant even more changes to the workplace (Eason, 2008; Hirschheim & Klein, 2012), and workplaces are now virtual, easing the constrains of time and location. Thus, autonomy in knowledge work also includes the authority to define the temporal, physical and practical boundaries of work (Mazmanian, Orlikowski & Yates, 2013). With the powerful entrance of cloud technology, we now see a convergence of social, mobile and cloud technologies influencing knowledge work and organizations in a more transformational way. For the remainder of the thesis, we refer to these technologies as SMC technologies. Virtual workers frequently operate in multiple teams rather than with the same colleagues every day. The organization of work is more spatially distributed. Coordination and control are carried out from a distance. Knowledge is stored in the cloud and accessed from anywhere. A consequence is that people become increasingly networked as individuals rather than embedded in groups. We refer to this as networked individualism. This organization of work stands in contrast to the arrangements formed around a hierarchy and small, densely knit groups, where people know each other very well and work together on a day-to-day basis (Rainie & Wellman, 2012).

Most virtual connected workers have jobs built around creative efforts rather than standardized processes. This thrusts even more autonomy and authority onto individual workers that become the autonomous center of work arrangements (Rainie & Wellman, 2012). In society, this process is called *individualization* (Carnoy & Castells, 2001). Individualization entails the process of *individuation* seen as the construction of autonomy by social actors who become subjects in a process of defining their own specific projects in interaction with, but not submission to, institutions (Castells, 2014). Individualization means freedom to use one's own resources (Castells, 2010, Baumann, 2011) and to have an individual approach to change while reducing the influence from a system (Baumann, 2011). Individualization can thus be said to be a powerful basic form of human behavior changing and minimizing the influence and role of institutions. Consequently, work practices in knowledge work are much more individuated than previously as well as much more flexible and unpredictable in relation to what a knowledge worker does, and what he will be doing in the future (Castells, 2014). These changes are not only the result of information technologies, but they are a combination of their features with organizational arrangements and changing practices that support their use (Zammuto et al, 2007).

The changes pose both opportunities and challenges to the individual worker, IS managers and business managers in the contemporary workplace. Opportunities in the form of productivity and innovation (Zammuto et al, 2007), speed and agility (O'Reilly & Tushman, 2013). Challenges in the form of how to plan and manage outcomes from the unpredictable combination of features and practices (Eason, 2008). It also presents a challenge to the organizational knowledge creation that according to Von Krogh (2012) becomes fragmented and personalized, thus inhibiting the accumulation of organizational knowledge from which enterprises compete.

This thesis is situated in Information Systems (IS) Research. A central issue in IS research is how to improve (knowledge) work in organizational structures enabled by information processing technology. A core purpose is to come up with robust theories and methods that can set the direction for positive impacts from IT in the human enterprise (Grover & Lyytinen, 2015).

Within IS research, several theories address the concept of autonomy. The theories of Duality-of-Technology (Orlikowski, 1992), Socio-technic (Trist, 1981) and Adaptive Structuration (DeSanctis & Poole, 1994) are such examples. These theories build on soft-determinism in which all human action is causally determined, however, that humans act autonomously when they are not constrained; as such they enjoy some control over and responsibility for actions. The relationship between autonomy and the application of technology is particularly dominant in IS theories. The common denominator of the three IS theories is the focus on explaining the mutual adaptation in the human enterprise that constitutes structures or systems that emerge over time. This makes IS theories well suited for addressing the challenges at the present workplace. What differentiates the IS theories from management and social theories is their specific focus on the reciprocal relationship between information processing technology and organizational actors organized in groups, using technology for a practical outcome in relation to work.

A focus in IS studies is often to explain the consequences of the interactive relationship between new technology and new human action in an organizational context (Hirschheim & Klein, 2012). Orlikowski (2000) summarizes this: "A community of users engaged in similar work practices typically enacts similar technologies-in-practice, where through common training sessions, shared socialization, comparable on-the-job experiences, and mutual coordination and storytelling, users come to engage with a technology in similar ways. Over time, through repeated reinforcement by the community of users, such technologies-in-practice may become reified and institutionalized, at which point they become treated as predetermined and firm prescriptions for social action, and as such, may impede change" (Orlikowski, 2000, p. 411). These processes are also labelled s*ocialization* and/or *institutionalization;* and they are dominating the IS literature (Robey, Anderson & Raymond, 2013; Besson & Rowe, 2012; Baptista, Newell & Currie, 2010; Avgerou, 2013; Orlikowski, 2000; and Ropohl, 1999). Institutionalization understood as embedding firm descriptions for social action, while socialization is the internalization of social norms arising from these descriptions.

The focus in the IS theories on group autonomy in relation to the effects of institutionalization and socialization from technology motivates our research. It counters to some extent the management and social theories describing the changing society and workplaces under influence of individual autonomy and individualization.

Our research thus began with a desire to examine if individual autonomy and individualization as a strong behavioral orientation in society and in the workplace was affecting the IS in ways not picked up by IS lenses and perspectives. If it was, it would serve as a contribution to both theory and practice. We were compelled to take a closer look.

Taking a closer look at autonomous knowledge professionals, we narrow our scope to cover the *interaction workers*. These types of workers do not lend themselves to standardized ways of working. Interaction work(ers) denote knowledge workers who increasingly inhabit the workplaces all around the world (Chui et al., 2012). In fact, the largest growing segment of workers in advanced economies are the interactions workers; 70% of new jobs created in the US since 1998 have been interaction jobs (Chui et al., 2012). As opposed to transaction work(ers), i.e. routine transaction jobs and tasks, taken over by automation and transformational work(ers), i.e.

manual work taken over by robots, these professionals undertake jobs with complex interactions and are required to deal with ambiguity. They exercise high levels of judgment and take complex decisions on the fly. These people are managers, salespeople, instructors and consultants, who most often draw on deep experience and tacit knowledge when making decisions. They are skilled professionals, whose jobs require them to spend a lot of their time interacting with other people (employees, customers, and suppliers) often in virtual and global settings. These interactions are mediated by digital technology of mobility and connectivity with social and cloud features, i.e. SMC technologies. Unified Communication and Collaboration (UCC) is an example of one of the most used technologies for mobility and connectivity. UCC gives people the opportunity to connect, communicate and collaborate with colleagues from anywhere and anytime, on any device, through a unified interface to chat, virtual meetings, video, calls, mails, calendar and presence indicators, etc. There is an infinite set of combinations of how to customize it. UCC is easy to use, not mandatory, and is not laden with a specific workflow (McAfee, 2006). The purpose of UCC is often to enhance productivity in knowledge work in global organizations (Silic & Back, 2016).

As already stated, productivity in knowledge work requires autonomy (Drucker, 1999), and we assume that these new technologies afford individual autonomy. Especially in the context of an environment where individualization has influenced the direction of orientation away from systems and groups toward the individual. Affordances represent a person's readily perceivable possibilities for action (Norman, 1998). We will take a closer look at SMC technologies applied in knowledge work settings, and we suspect that the possibilities for autonomous and individual action show similar effects in the IS, as individualization does in society. We assume that individual actions are carried out by individuals that are different and have different needs and intentions (Archer, 2015; Hofkirchner, 2014). However, they are organizational members who are social actors but act with a self-oriented autonomy less anchored in and less influenced by the system (Castells, 2014; Benkler, 2006). In this current setting of knowledge work, we assume that the influence from individualization is greater than exposed in the previously mentioned IS theories. Consequently, if this is the case, our perspective of how to understand the IS and how to change it must include individualization effects as well. This would provide managers and designers with more precise and relevant ways to address outcomes from implementation of various technologies in the organization. It would potentially shape the practical discussions of how to achieve change. Thus, our primary aim is to develop a change framework that meets the complex challenges represented by SMC technologies in the 21st century workplace.

The main research question is: *How is socio-technical change achieved under the sway of technological individualization in knowledge work settings?*

As the question suggests, we have chosen to apply a socio-technical perspective. The socio-technical perspective is a distinct way of looking at, understanding and explaining the IS and how it works. Socio-technic is one of IS' native theories, dating back to the early 1970ies (Straub, 2012). It was originally formulated for IS by Bostrom and Heinen (1977). When adopting the socio-technical perspective, IS researchers understand the organization as an IS composed of elements of a social character and a technical character (Trist, 1981; Lee, 2010). These have equal impact on the systems performance (Eason, 2008; Mumford, 2006; Trist, 1981). Neither the technical nor the social determine the output; it is the socio-technical system that performs and produces outcomes. The socio-technical perspective differentiates in its philosophical underpinnings form other theories in IS research by being neither technological deterministic nor social deterministic. The socio-technical perspective relies on socio-technical system thinking, which in turn relies on system thinking that sees "a whole composed by its parts in a purposeful way" (Ropohl, 1999, p. 1). A core tenet in a socio-technical system is that the technical sub-system and the social sub-system, when jointly optimized, can result in both instrumental and humanistic objectives at the same time (Sarker, Chatterjee & Xiao, 2013). This harmony or fit between the social and the technical is reached through the process where an autonomous group of people, collectively bound in one work system, adopts and adapts techniques and technologies, eventually fostering a common work culture. Ropohl (1999) explains this process as caused by mechanisms of *technological institutionalization* and *technological socialization. Mechanisms* in the sense that they explain "the cause of something"; and what 'enables' or 'leads to' it" (Sayer, 1992, p.104.). *Technical institutionalization* is the

assumption that every technical product incorporates functions which have previously been a personal ability, knowledge and intention and thus inside a certain individual person. This is externalized and objectified in the technical system and thus generalized beyond the individuals. This process of trans-individual generalization of value and behavior patterns is called institutionalization in sociology, and hence, technical development has to be understood as technical institutionalization (Ropohl, 1999). *Technical socialization* means the process of when institutions (in the abstract meaning) channel and shape the behavior of the individuals and integrate them into a common culture, an effect, which is called socialization in sociology. Formerly, this mainly happened through human communication, but nowadays, technical products exhibit the same performance. When utilized within the socio-technical system, they transfer their institutional power to the individual (Ropohl, 1999).

We have chosen to focus on the socio-technical perspective for several reasons.

A current debate in the IS community is how to anchor the socio-technical perspective in the 21st century. In recent years, scholars have asked *if* we can port the socio-technical perspective to the dynamic nature of the 21st century enterprise (Bjørn-Andersen & Clemmensen, 2017). According to Sarker, Chatterjee and Xiao (2013), socio-technic *is* our IS research. However, IS scholars and practitioners, have skewed the socio-technical understanding by not being faithful to the traditional conception of the socio-technical understanding of equal focus on the two-subsystems. Instead, the focus has been on the technical subsystem and instrumental objectives. Rhetorically, Sarker, Chatterjee and Xiao (2013) ask if socio-technic should be discarded or if a new socio-technical understanding built around new conceptions of interactions between the social and the technical, between design vs. improvisation and separation vs. entanglement ontology view could render it relevant (Sarker, Chatterjee & Xiao, 2013). Likewise, Eason (2008) calls for renewed understanding of the socio-technical perspective and underlines its potential relevance in a world where flexible, multifunctional information and communication technologies are being regularly implemented into existing operational work systems (Eason, 2008). We can thus engage ourselves in this current discussion.

We believe that a socio-technical perspective has relevance in the contemporary enterprise of knowledge professionals. Most importantly, we believe that one of socio-technique's main missions on delivering on both economic and humanistic objectives is as important today as it was then (Mumford, 2006). This entails a bifocal view on how changes occur and what objectives are set. Likewise, to achieve practical and productive outcomes from the expanding usage of technology, we believe that paying attention to changes in both the technical and the social side of structures is important. Thus, we can facilitate in highlighting these issues.

The socio-technical perspective has a practical orientation towards solving issues of imbalance and misfits between technology and humans (Mumford, 2006). We believe that we can help managers and designers in their efforts to re-balance and harmonize the complex interplay of technology and people. How to understand and harmonize the different affordances from IT in the organizational setting becomes more important. A new perspective that explains outcomes will become valuable.

The term, a socio-technical system, is usually applied to any instantiation of social and technical elements engaged in goal-directed behavior within an organization. Using the term implies a recognition that organizations have boundaries and that interactions occur within its sub-systems. However, it is also an open system that responds to the wider context and dynamics of the environment. Thus, in theory, we assume that we will be able to see if and how the settings we study are affected by societal changes such as individualization.

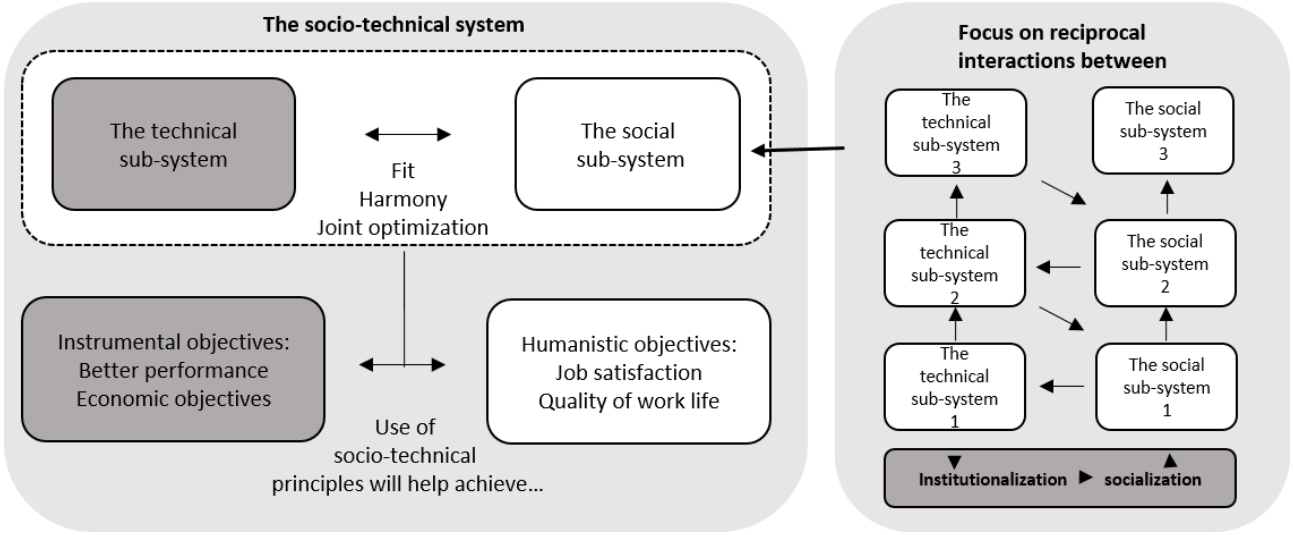
The above reasons point in the direction of a need to reconsider some aspects of the traditional socio-technical perspective when applying it to the present world of work. Reconsidering the socio-technical perspective is our second aim in this thesis. As Zammuto et al (2007) say: "The phenomena we study […] are changing due to the ubiquitous adoption of information technology by individuals and organizations. Unless our theories reflect the changes in those phenomena, we run the risk of our theories and research becoming irrelevant" (Zammuto et al. 2007, p. 750).

Our efforts in studying the contemporary setting of autonomous knowledge workers will provide richer descriptions of current phenomena, and our effort in addressing it from a socio-technical perspective, will reveal challenges that can inform if core tenets in the perspective needs re-considering. We assume that effects from individualization will be such a challenge.

Reconsidering means to address something again with the intent to alter it. Thus, our point of departure is the traditional basic elements and dynamics that constitute the socio-technical perspective as described in Mumford (2006) and Eason (2008) and presented in figure 1. The perspective holds two *main* concepts: the socio-technical system (left grey area), and how it interacts, progresses and delivers on outcomes (the right grey area). The left area in figure 1 draws on the outlay of the socio-technical system as visualized in Sarker, Chatterjee and Xiao (2013, p. 5), with darker grey we have highlighted the present focus, as criticized in Sarker, Chatterjee and Xiao (2013). The right grey area is inspired by the visualization in Lee (2010, p. 340) and portrays how the social and the technical sub-systems interact (establish fit, harmony and joint optimization) as a continuous, reciprocal and upward movement in which the social adapts to the technical and the technical adapts to the social (the small arrows). We have included the previously described and assumed processes of institutionalization and socialization in their capacity as drivers in the upward moving spiral represented, in the small dark grey box, bottom right.

Our primary aim is to contribute with a new framework of how socio-technical change is achieved in the present world of work. Thus, we seek to understand and explain how the socio-technical system operates, and how the sub-systems interact, when studied in the setting of global and virtual enterprises inhabited by interaction workers. The secondary aim is to address and reconsider the assumptions behind figure 1, based on our studies. This will provide us with an opportunity to deliver a socio-technical perspective with explainable relevance in the contemporary enterprise.

Figure 1. The socio-technical perspective



Methodologically, we have chosen a critical realist (CR) approach to answer the research question. CR denotes a view in which the real world consists of generative mechanisms, not solely of empirical phenomena. A generative mechanism is a trans-empirical real existing entity that explains why observable events occur. First, we describe phenomena from the empirical and theoretical domain. Then, we derive the generative mechanisms, causing phenomena. Conveying the layer of mechanisms from contemporary phenomena serves the purpose of deriving knowledge that gives a more objective approach to reconsider the socio-technical perspective and the underlying mechanisms *then and now,* and it gives an approach to explain the cause of socio-technical change.

We are motivated to provide a contribution to practice, in terms of suggesting a framework of socio-technical change that can act as a sense-making device in discussions when planning and explaining varied outcomes from implementations.

1.1 Modus Operandi

To operationalize the research process, we systematically broke down the main research question (RQ) into three sub-questions (see section 2). Three critical case studies, several theoretical reflections and literature reviews were conducted over the course of three years in order to answer the main RQ through three phases driven by a sub-question each. The main *modus operandi* has been to respond to relevant track calls from Information Systems conferences, all of which focused on socio-technical aspects in relation to knowledge work, new technologies and organizational transformation. Communicating research is a craft that develops through practice. Thus, this thesis covers a collection of nine empirical and conceptual papers – accepted, presented and published as part of official pre-conference workshops, at main theme tracks at international conferences and in one international journal.

Table 1. Research phases and articles

First phase	Second phase	Third phase
Methodological approach: Empirical and analytical papers. Hermeneutical analysis on autonomy and productivity phenomena from critical case studies of interaction workers in work settings enabled by UCC.	Methodological approach: Conceptual and theoretical papers inquiring into how the socio-technical system and perspective compares to current phenomena. Shifting from a focus on phenomena to an interest in generative and social mechanisms.	Methodological approach: Empirical and analytical papers. Analysis of mechanisms at work in the current setting of knowledge work, in relation to consequences it poses for theories and the socio-technical perspective.
Papers	Papers	Papers
#1 "Co-configuration in Interaction Work." Co-author Lene Pries-Heje. *IRIS 2015, Oulu*	#4 "Sociotechnical practices and complexity: Studying working in the Cloud." *IRIS 2016, Ljungskile*	#7 "Revising the Socio-technical Perspective for the 21st Century: New Mechanisms At Work." Co-author Richard Baskerville. In *International Journal of Social and Organizational Dynamics and IT. Accepted and date pending.*
#2 "Misfits in Knowledge Work - Grasping the essence with the Kita framework". With Lene Pries-Heje *Conference proceedings of KMIS 2015, Lisboa*	#5 "Networked Individualism: Toward productive work practices with IT-Knowledge artefacts." *IRIS 2016, Ljungskile*	#8 "The Digital Individual: The Changing Nature of Knowledge Creation." *Pre-workshop. IFIP 9.1. ICIS 2017, Seoul*
#3 "Persuasiveness, Personalization and Productive Workplace Practices with IT-Knowledge Artefacts". With Lene Pries-Heje. *PT 2016, Salzburg.*	#6 "Double-edged Social Mechanisms at Work in the 21st century Information System: Opportunities and Challenges." Literature review. *Conference theme track. In proceedings of PACIS 2018, Yokohama*	#9 "Socio-technical Change: The equilibrium Paradox." With Richard Baskerville. *Conference theme track. In proceedings of ECIS 2018, Portsmouth.*

It has been a priority to collaborate with both internal and external colleagues and individually. On three articles, my supervisor Lene Pries-Heje participated (paper 1-paper 3). I am the sole author on four articles; these are papers 4 -6 and paper 8. Papers 7 and 9 are in collaboration with Richard Baskerville and in

combination with a visiting scholarship at Georgia State University in two periods of 2017 (April/May and September/October). Thus, the thesis is a collection of double-blind and peer-reviewed papers. Table 1 is an overview of what manifests as three phases undertaken in this thesis, primarily differentiated by different methodological approaches.

1.2 Structure and reading suggestions

Section 2: Research question. This section presents the main RQ and the three sub-questions (SQ). Each SQ constitutes a phase in the research process that yields three papers as presented in table 1.

Section 3: Results. This section presents the results from each paper and each phase. This presentation reflects the progression made from phases 1-3 and, additionally, how the results from each phase contribute to answering the SQs, and eventually the RQ. Each phase and subsequent SQ is explained. Each of the papers is presented, with the results it yielded. We describe scope, objective and RQ within each paper and reflect on how each paper contributes to answering the SQ; then how they together contribute to answering the RQ. Then we answer the main RQ: *how is socio-technical change achieved under the sway of technological individualization?*

Section 4: Methodology. This section presents and motivates the research design, paradigm and methodology.

Section 5: Contributions and discussion. This section presents and discusses the contributions that each SQ and each paper provides. Some of the contributions relate to gaps, while others pertain to challenges with underlying assumptions. As the main contribution, a new socio-technical change framework is presented based on the results. Then, we discuss the socio-technical perspective. Ultimately, we present practical discussion points aimed at managers, IS managers and designers, responsible for achieving successful outcomes from their IT implementations in knowledge work settings. Then, we present further research areas.

Section 6: Conclusion. This section concludes on the research.

Section 7: Glossary. This section holds an overview of key concepts in alphabetical order. We suggest using this glossary when concepts need more clarification than explained in the text.

References. The reference section pertains directly to references used in this cover, some of which overlap with the reference sections in the papers.

Reading suggestions

The papers are in their full length and in order of appearance in appendix 1-9. We recommend reading them during the reading of section 3.

2. RESEARCH QUESTION

As presented in the introduction, we have a primary and a secondary aim with this thesis. The primary aim is to explain socio-technical change under the influence of technological individualization; the secondary aim is to take part in the current debate on how to port the socio-technical perspective to the contemporary setting of knowledge work in the 21st century enterprise.

The main RQ drives and sets the direction of the theoretical and empirical research. When the main RQ is answered, the insights provide us with a platform on which we can reconsider the socio-technical perspective. The RQ is divided into three sub-questions. In answering each sub-question and responding to research calls, it resulted in three distinct papers per sub-question.

However, the chosen modus operandi of responding to relevant research calls from the IS community did impact the particular formulation of research questions in each paper, so did reviewers, co-authors, supervisors, senior scholars and colleagues' comments and valuable feedback along the way. This improved the papers and research immensely, but it also gave way for other aspects and perspectives that are in the articles but not summarized in this thesis. In section 3, we explain the specific RQ in each paper, and how this relates to answering a sub-question, eventually how it answers the main RQ.

Main RQ: *How is socio-technical change achieved under the sway of technological individualization*?

To answer this question, three sub-questions have been formulated:

SQ1: *How is social, mobile and cloud (SMC) technology experienced in knowledge work settings?*

Answering this question drives empirical research to derive relevant aspects from phenomena related to use of SMC technology in the settings of knowledge work. The aim is to provide descriptions and understanding of current phenomena pertaining to knowledge work in virtual and global organizations inhabited by interaction workers using UCC. The socio-technical perspective, as visualized in figure 1, influences the analysis.

SQ2: *How does the socio-technical perspective – in theory – acknowledge new phenomena in knowledge work settings?*

Answering this question drives theoretical research that is conjectural in nature. The aim is to provide clarity of basic assumptions in the socio-technical perspective. When conjectured, we can compare it to basic assumptions underlying new phenomena derived from answering SQ1. We seek to uncover to what extent new phenomena are compatible with assumptions in the socio-technical perspective.

SQ3: *How have mechanisms changed, and what are the implications to socio-technical change theory?*

Answering this question drives empirical and conjectural research. The aim is to provide knowledge and new insights into the layer of social and generative mechanisms *at work* in the socio-technical system and to observe if these mechanisms can explain new phenomena and events from the previous two phases. This provides a platform to explain socio-technical change from the level of mechanisms; and how this eventually challenges core tenets in socio-technical change theory.

3. RESULTS

In this section, we describe the results of our research. To answer the main RQ, we posed three SQs. We introduce each phase that pertains to a sub-question. Then, we present the aim and RQ in each paper and explain how it relates to the SQ. Then we present the abstract of the paper and highlight the results. We reflect on the knowledge acquired and new knowledge needed after each paper. In particular, the reflection notes constitute a thinking and reflection process; a historical narrative that explains the author's line of thought, mindset and academic progression. At the end of each phase, we summarize how we answered the SQ and the main results. In the end, we summarize the results and then we answer the RQ.

3.1 Phase 1 and sub-question 1

SQ1: How is social, mobile and cloud (SMC) technology experienced in knowledge work settings?

First, we wanted to focus on the phenomena of autonomy and productivity in interaction work. The causal relationship as prescribed by Drucker (1999) and the autonomy paradox found by Mazmanian, Orlikowski and Yates (2013) in which mobile phones provided possibilities to work anytime/anywhere resulting in all-the-time/from-everywhere were both interesting aspects in relation to understanding the contemporary setting. We wanted to analyze productivity and autonomy under the influence of increased human-human interactions in the workplace. We wanted to see if new aspects, from the relationship between SMC and individual workers, on autonomy and productivity would surface.

3.1.1 Co-configuration in Interaction Work, IRIS 2015

Starting in late March 2015, we responded to the call from IRIS 2015 in April 2015. We asked: *What are the implications of the increased amount of human-to-human interactions in the contemporary workplace when supported by Interaction IT? How does it affect and challenge autonomy and productivity?* We discussed the paper at IRIS 2015, in August in Oulu, Finland. The full paper is in Appendix 1.

Co-configuration in Interaction Work

Louise Harder Fischer & Lene Pries-Heje

Abstract. How to increase knowledge workers' productivity is still a puzzle. While knowledge work has become increasingly virtual, collaborative and interactive, we still witness challenges in the area of productivity. We challenge the widespread perception of the causal relationship between high autonomy and high productivity in knowledge work and the fact that configuration and standardization for improving productivity is logically impossible. With a hermeneutical approach, we describe and interpret "what is going on" in two different contexts of interaction knowledge work. Findings suggest that knowledge workers often feel caught in counter-productive practices with technology due to the autonomous use of Interaction IT and the challenge of configuring work. We witness different behaviors related to "the autonomy paradox", and we see something interesting happening when introducing Interaction IT. While configuring work should lower autonomy and negatively influence productivity, we see the opposite. While increased autonomy should increase the productivity, we also see the opposite. We interpret the findings as a balance between autonomy loss and productivity gain and as such deliver new insight into the autonomy paradox.

Keywords: autonomy, autonomy paradox, interaction workers, co-configuring, work practices, Interaction IT, productivity

Results

The analysis revealed different outcomes in relation to co-located and distributed work settings and how autonomy and productivity were produced and experienced in relation to usage of UCC. In the co-located setting, we observed a perception that organizational productivity was low and autonomy too high when adopting UCC. However, workers perceived themselves as being productive when configuring their usage to own needs and preferences. In the distributed work setting, the interaction workers succeeded in co-configuring interactions using UCC in concerted ways. They perceived high productivity and high autonomy. The primary result was:

- New aspects on the autonomy paradox and in the autonomy-productivity causal relationship.
- We found two different ways of balancing. 1. How autonomy in one area (choice of location) might result in willingness to minimize it in another (being willing to co-configure). 2. That a perception of less autonomy in one area (fixed location) might result in maximizing it in another area (individual behavior with technology), thus halting productivity at the group and organizational levels. How to balance was highly influenced by perceptions of being productive.

Reflections

Reflecting on the outcomes of the relationship between SMC and the users, from a socio-technical perspective, we saw fits at the individual level but misfits at the organizational level. While simultaneous fits and misfits at different levels are difficult to explain as productive outcomes and as a jointly optimized socio-technical system, we saw the co-located case as a subject for further study of the experience with SMC in knowledge work.

3.1.2 The Misfits in knowledge work – grasping the essence, KMIS 2015

In July 2015, we responded to a call inviting us to use an interpretative lens of how to understand Knowledge IT artefacts (Cabitza & Locoro, 2014). We suspected this lens could offer more understanding of the issues with misfits in co-located cases. We conducted a follow-up interview with a manager and focused on specific usage of UCC features in relation to horizontal interactions with colleagues both co-located and distributed in other regions of the world. We asked: *How can we categorize UCC as a specific form of IT knowledge artefact? What follows from this categorization?* We discussed the paper at KMIS 2015 in November in Lisboa, Portugal. The full paper is in Appendix 2.

The misfits in knowledge work

Grasping the essence with the lens of the IT Knowledge Artefact

Louise Harder Fischer and Lene Pries-Heje

Keywords: IT Knowledge Artefact, UC&C, situativity, socio-technical fit, individual practices, knowledge creation.

Abstract: The workplace is changing rapidly, and knowledge work is conducted increasingly in settings that are global, digital, flat and networked. The epicenter of value creation is the individuals and their interactions. Unified Communication and Collaboration Technology (UC&C) supports individual interactions, collaboration and knowledge creation. The use of this technology is growing globally. In a previous study, we found that UC&C in co-located and distributed settings produced misfits and fits between situated, enacted practice use of UC&C and the experienced productivity. We respond to the KITA 2015 call with this work-in-progress paper. We apply the IT Knowledge Artefact (ITKA) interpretive lens from Cabitza and Locoro (2014) to a case of knowledge workers struggling with appropriation of UC&C for creating and sharing practice knowledge. We evaluate the framework - and discuss the usefulness of the lens in this specific setting. To further improve and enrich, we pose questions, aiming at contributing to the communication of valuable insights informing the design and use of future KITAs in knowledge work.

Results

From the analysis, we found that the situated use of UCC – used as an efficient knowledge transfer tool of codified knowledge – minimized face-to-face interactions and inhibited the sharing of practice and informal knowledge among members in the organization. This was experienced as diminished sociability in the workplace. However, increased individual productivity was experienced, since the usage of UCC minimized time used for travelling and face-to-face meetings.

However, we used the lens to categorize UCC as a socially situated IT knowledge artefact supporting practical and actionable knowledge. As such, it should act as a scaffold to the expression of information practices and knowledge. The ontology is practical, and the epistemology is clearly interactionist and emergenist, and knowledge should emerge through interactions with data and people. However, in the context of the case, none of these characteristics showed. In theory, the malleable nature of UCC will result in socio-technical outcomes (fits). This did not happen in this case. Our main results were:

- End-user malleability does not necessarily result in a socio-technical fit.
- UCC can be formed and shaped by users to such an extent that the purpose is fundamentally changed.

Reflections

We rose a number of questions. How do we tackle UCC as a dynamic IT knowledge artefact in a socio-technical perspective? How do we categorize ITKAs influenced by both individual and organizational appropriation, changing the intent with the design profoundly? Do we evaluate ITKAs based on intentions in design or intention in use? How can we categorize UCC using the lens, when it can support both tacit/explicit- and process/practice knowledge?

Our meta reflection on the outcome from this exploratory exercise was that, when seen in a socio-technical perspective, the humanistic objectives were not met while the more economic were. Thus, we experienced difficulties in describing UCC as amounting to joint optimization between the social system and the technical system. Lastly, and when reflecting on the outcomes of now two research papers, we still struggled with understanding fit/misfits at the individual level and the simultaneous fits/misfit at the organizational level.

We speculated if UCC, as an IT knowledge artefact, took color from the dimensions of the knowledge dimension it supported. Knowledge dimensions understood as tacit and explicit knowledge converted from individual, group to organizational knowledge. Our line of thinking was influenced by the SECI model from Nonaka (1991). The SECI model distinguishes four knowledge dimensions – socialization (individual), externalization (group), combination (organizational), and internalization (individual), each with a different purpose and at different levels in the organization.

To further our understanding of UCC in knowledge work settings, we needed further research. From paper 1, we saw issues on *balancing* individual productivity and autonomy in a dynamic relationship between technology and/or location, and from paper 2, we saw the simultaneous fits and misfits at individual and organizational levels.

When presenting the paper 2 at KMIS 2015, another paper by Zelaya (2015) presented results from a study of knowledge work productivity in relation to personality traits. It showed a correlation between personality traits and specific preferences of knowledge conversion processes related to the SECI model. We found this perspective interesting in terms of giving clarity to SMC technologies' malleable nature and how it catered to individual autonomy.

3.1.3. Persuasiveness, Personalization & Productive Workplace Practices, PT 2016

In late December 2015, we therefore responded to a research call on personalization and persuasiveness in technology. We were curious to see if personality trait issues – a concept increasingly applied in personalization and persuasive design projects (Alkis & Temizel, 2015) – could explain why organizational misfits arose from fits at the individual level. Consequently, how these differences in personality could be

addressed by persuasive system design strategies (Oinas-Kukonen & Hajumaa, 2009). Our intention was to look for ways in which we could establish joint optimization, catering to both individual productivity and efficient knowledge sharing. We explored if, in theory, it was possible to design SMC to trigger individual productivity and organizational knowledge sharing? We presented the paper in April 2016 at the pre-workshop "personalization and persuasiveness" in relation to the conference Persuasive Technology 2016 in Salzburg.

Persuasiveness, Personalization & Productive Workplace Practices with IT-Knowledge Artefacts

Louise Harder Fischer, Lene Pries-Heje

Abstract. The workplace is getting increasingly globalized, virtualized and networked. At the same time, work itself has become discrete, autonomous and complex. In a fast-changing world, the individual knowledge worker and his interactions become the new locus of value creation. Management promote – not dictate – lateral technologies to enable interaction among peers – the core of knowledge creation. To target productive behavior, the knowledge professional appropriates these technologies building individualized IT knowledge artefacts. This practice leads to several dilemmas in enterprise-wide knowledge work. We see a possible way forward for improving workplace practices with IT knowledge artefact-based applications, by combining new insight into how different personality traits prefer different knowledge-sharing processes with new insight into personalizing persuasive technology. We explore new research and argument for further research in an attempt to solve the dilemmas in the networked enterprise.

Keywords: Workplace practices**,** IT knowledge artefacts, Individualization, Knowledge Creation, Productivity, Autonomy, Persuasive Technologies.

Results

The aim of the exercise was to establish *if* productive workplace practices with personalized persuasive ITKA-based design strategies could amount to more shared and concerted knowledge-sharing practices covering the entire SECI spiral. We hypothesized on personality traits and categorized the distributed/mobile worker and the co-located/office worker as having two different personalities. The main result was:

- We found several design principles that could enable ITKAs in supporting individual productivity and organizational knowledge sharing.

Reflections

We have not followed up on this relevant issue. Thus, we have provided a research path that could include design science research methods in the future.

3.1.4 Summation of results

How is social, mobile and cloud technology experienced in knowledge work settings?

The studies of the experiences in interaction work applying the more specific SMC technology of UCC revealed aspects of autonomy, productivity, malleability, flexibility, fits and misfits at individual and organizational levels. The main findings were:

- The studies revealed unpredictable outcomes and increased complexity, when individuals took center stage in how to engage with malleable technology and how to obtain productive practices: in one case, fits at both levels were experienced, while in the other case, misfits at the organizational level were experienced.
- We observed a pattern of maximizing and minimizing individual autonomy in a complex interaction between perceived productivity, location and SMC technology.
- We categorized UCC as a situational IT knowledge artefact with extreme malleability in relation to serving as a tool in the setting of knowledge work, appropriated by interaction workers. It could be individually appropriated with negative social and organizational consequences, and it could provide possibilities for co-configuring practices, amounting to perceived individual productive outcomes.
- We found that knowledge sharing and appropriation of technology can be very personalized due to different personality traits preferring different knowledge conversion dimensions.

In relation to how SQ1 contributes to answering the main RQ, we conclude that the autonomous individual in the socio-technical system influences the overall outcome in negative and positive ways. Thus, individual appropriation of SMC influences how to successfully obtain socio-technical change.

Reflections on phase 1 – SQ 1

Having gathered a deeper understanding of how SMC was experienced in knowledge work settings by applying a socio-technical perspective, we could move on to a more theoretical investigation of the basic assumptions underlying the socio-technical system and its perspective. We wondered how the socio-technical perspective in theory could acknowledge the rising complexity at the workplace due to aspects of unpredictability in the outcomes from individual and autonomous practices afforded by SMC technology. Until now, applying this perspective resulted in labels such as misfits and unsuccessful optimization between technology and the social elements. We needed deeper theoretical understanding of socio-technical system theory. The theoretical exploration constitutes phase 2 and SQ 2.

3.2 Phase 2 and sub-question 2

SQ2: *How does the socio-technical perspective – in theory – acknowledge new phenomena in knowledge work settings?*

Answering this question drove theoretical research that was conjectural in nature. The aim was to provide clarity of how the socio-technical perspective, holding certain assumptions and characteristics, reached a well-functioning socio-technical system. We wanted to compare with basic assumptions underlying new phenomena in the contemporary workplace. Basically, we sought to illuminate the fitness of the socio-technical perspective, in relation to contemporary knowledge work phenomena denoting aspects of individual productive practices, autonomy, malleability in technology, unpredictability in outcomes, and the individual worker balancing autonomy in a complex relationship between productivity, technology, practices, processes and location.

3.2.1 Networked Individualism: Toward productive work practices with IT Knowledge artefacts, IRIS 2016

We responded to a call from SCIS/IRIS 2016 with the theme "Living in the Cloud". We constructed a "clash/complement" question driving the theoretical exploration. We asked: *Does end-user malleability and*

the consequential individualized appropriation (due to networked individualism) clash or complement with the socio-technical perspective?

Networked Individualism:
Toward productive work practices with IT knowledge artefacts

Louise Harder Fischer

Abstract: In this position paper, we theoretically reflect upon the changes from technology happening right now in the workplace and how it connects with productivity in knowledge work. While enterprises become flatter and work more networked, the individual knowledge worker takes center stage in the locus of value creation. Supported by social, mobile and cloud technologies, a transformation of knowledge work, as we know it, has begun. To support individual and collaborative knowledge processes and to fit different contexts, technologies are end-user malleable. End-user malleability is an application feature designed with intent of supporting joint optimization through contextual and situated appropriation in an organizational context. As such, the organization and the individual have an opportunity to continuously and reciprocally create a socio-technical fit – achieving both economic and humanistic objectives. With increased empowerment of individuals and autonomous appropriation of IT knowledge artefacts, we predict both positive and negative outcomes. We seek to bring forward a theoretical discussion of the complex reality of networked individualism, and how it affects the otherwise anticipated organizational deployment of IT knowledge artefacts for productivity in knowledge work.

Keywords: Networked individualism, knowledge work, productivity, appropriation, end-user malleability, IT knowledge artefacts

Results

Phase two opened a discourse around individualization at the workplace. We wanted to see how this movement would clash – in theory – with the socio-technical perspective. We used the concept of Networked Individualism from Rainie and Wellman (2012). Networked individualism reflects a new workplace *modus operandi* of individuals operating personal networks of multithreaded communication streams holding many different work relations, empowered by SMC.

- We found support for previous findings that the socio-technical perspective seemed unable to explain fits at the individual level and misfits at group and organizational levels emerging from individual appropriation of SMC technology, i.e. situational IT knowledge artefacts.
- It is logically impossible to plan the actual outcome of malleable technologies. This renders the belief of planning and managing social change ill-suited in the present environment.

Reflections

We suspected that an adjustment of the socio-technical perspective with a view on joint optimization between practices and technology, from the perspective of the individual, would increase complexity. How to plan and manage socio-technical change would become more complex. Thus, the next exploratory exercise was to explore how the socio-technical perspective – in theory – would acknowledge complexity issues.

3.2.2. Sociotechnical practices and complexity: Studying working in the cloud, IRIS 2016

In relation to the practical settings of our research, we asked: *What does the socio-technical lens reveal and, does it generate new knowledge improving our understanding of working in the cloud?*

Sociotechnical practices and complexity: Studying working in the cloud

Louise Harder Fischer

Abstract: Cloud, mobility and social media are profoundly changing knowledge work practices. Transformation of how to solve problems, take decisions and how to interact alter the locus of value creation. Studying the ongoing interactions among people, technology and organizations, situated historically and contextually, is the core of IS research. To move forward the development of IS theory, we present a theoretical discussion for why working in the cloud requires us to continually adjust our lens when studying aspects of complexity and practices. We contribute to the ongoing debate of – and development of – the socio-technical lens, suggesting how we open up to practice and complexity aspects when working in the cloud.

Keywords: Social Technologies, Socio-technical, Complexity

Results

Through the theoretical exercise, we gained a deeper understanding of the focus and core tenets in the socio-technical perspective. Main results were:

- We found that a separation ontology is a core tenet in the socio-technical perspective. This belief explicitly reveals what is technical and what is social.
- The idea of planned, interventionistic and managed change is deeply rooted in the perspective. So is a linear approach to change.
- Traditionally, the lens is applied to a work system. A work system consists of practices, people, information, and technology as well as its outputs (products/services) and the external environment. Thus, work systems are understood as socio-technical systems by default.
- The socio-technical lens reveals aspects of 1) balance/imbalance between the social and the technical components (with an even-handed emphasis), 2) the reciprocal interactions between the two sub-systems, 3) fit, harmony, and/or joint optimization between them 4) and dual objectives (instrumental and humanistic).
- We found that the above characteristics and assumptions hinder revelations of the complexity rising from unpredictable outcomes and various effects from random and individual appropriations of technology.
- We concluded that we needed an adjusted lens, also addressing joint optimization in the interaction between behaviors and technology, from the perspective of the individual in knowledge work settings.
- The socio-technical perspective would not acknowledge the emergent interaction patterns that are more individual, practical, interactionist and actionable when working in the cloud. It would be characterized as misfits.

Reflections

Revealing what is individual-technical and what is socio-technical would provide value in the present context. It would likewise provide a way to view individual autonomy as a balance between minimizing and maximizing autonomy, aiming at productive outcomes. However, in order to understand how a socio-technical

system holding a dual-level ontology would produce productive outcomes, we shifted to CR. Critical realists understand the world, not by phenomena, but by what causes phenomena. We assumed that, when introducing a new analytical level in the socio-technical system, it could raise complexity. However, if we decided to move our analysis to the level of mechanisms that account for outcomes in an open system, it could contribute to simplifying the complex issues revealed so far. Turning to CR and looking for mechanisms that can explain outcomes turned out to be difficult but productive.

3.2.3 Double-edged Social Mechanisms at Work in the 21st IS PACIS 2018

We responded to the call from PACIS 2018. The theme of the conference was "Opportunities and Challenges for the Digitized Society: Are We Ready?" We submitted to the theme track. The call asked for contribution of research that pertained to opportunities and challenges in relation to emerging patterns and dynamics of work in an organizational and individual perspective.

We asked: what are the social mechanisms beyond the IS, and how can we explain the causal paths of how IT artefacts trigger different outcomes in the IS?

Double-edged Social Mechanisms at Work in the 21st century Information System: Opportunities and Challenges

Completed Research Paper

Louise Harder Fischer

Abstract: *A long-held explanation in IS research is that any change in the Information System (IS), through the introduction of new IT artefacts, triggers a chain of events leading to institutionalized routines and synchronized social practices. This explanation no longer covers the dynamic outcomes in the workplace set in motion by different types of IT artefacts. We adopt a critical realist philosophy that entails illuminating how IT artefacts trigger social mechanisms in the human enterprise. We review IS literature on the IT artefact phenomenon from 2001 and forward. We find that the mechanism of individualization is forcefully triggered by new generative IT artefacts, while enterprise IT artefacts trigger institutionalization and socialization. We critically assess the opportunities and challenges this presents for managers and designers when managing an IS that holds both types of artefacts. We draw a conceptual model of the now dual-IS, with double-edged mechanisms that can correspondingly empower ambidextrous organizational forms.*

Keywords: IT artefacts, enterprise IT artefacts, generative IT artefacts, social mechanisms, critical realism, dual-IS

Results

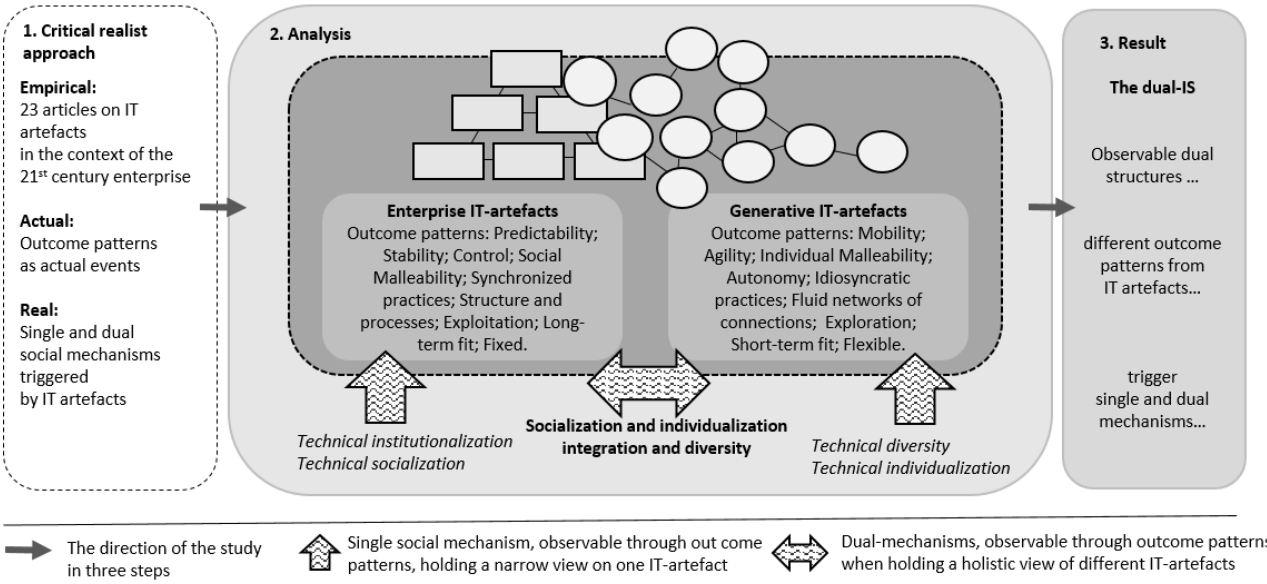
We succeeded in drawing a conceptual and holistic model of the IS that can explain the social mechanisms triggered by IT artefacts, producing certain outcomes, see figure 2. According to Gross (2009), mechanisms are seen as triggered causal powers. Mechanisms are what enable a certain behavior or lead to a certain outcome (Sayer, 1992). Mechanisms are unobservable and operate only when suitably triggered (Gross, 2009).

- We developed a theoretical set of social mechanisms. The mechanisms were institutionalization, socialization, individualization, diversity and integration. If triggered, they would cause events and outcomes in the system.
- When porting them into the IS, and inspired by Ropohl (1999), we added *technical* in front of them. As an example, institutionalization is the act of embedding a norm, a specific behavior into an organization. When an IT artefact triggers the mechanism of institutionalization, the IT artefact

embeds a norm or a certain behavior in the social system. This is technical institutionalization. Individualization, as an example, is a process in which the individual defines his own way to operate based on personal values and self-oriented preferences. When an IT artefact triggers this mechanism, we call it technical individualization.

- We deducted two meta-categories of IT artefacts present in the 21st century IS. We labelled them generative IT artefacts, denoting those generative individual creative processes that are triggered by malleable and mobile IT artefacts producing unpredictable outcomes.
- We found outcomes such as fast-changing individual work modes, individualized portfolios and network formations.
- We inferred that a generative IT artefact could forcefully trigger the process of technological individualization. However, these outcomes and triggers were only observable in a smaller number of papers from 2008 and after.
- The socio-technical mechanisms of technological institutionalization and technological socialization were by far the dominant mechanisms most often triggered. The second meta-category was enterprise IT artefacts, denoting fixed, intentional, process-specific IT systems with predictable outcomes. The enterprise IT artefact triggered the mechanisms of institutionalization and socialization.
- From a few theories, we could see how these mechanisms complemented each other. As an example, individualization and socialization could be triggered in the IS as a double-sided mechanism, both being active at the same time. One example was Kallinikos (2002) who pictures IT artefacts on a continuum from predictability to malleability.

Figure 2. Three-step process and the holistic model of mechanisms and IT artefacts



- The holistic model of the IS, with different IT artefacts, shows how the mechanisms of technological individualization, socialization and institutionalization can enable each other. When they do, the system could morph into a dual-structure system, denoting both a network and a hierarchy. Inspired by the concept of ambidexterity from O'Reilly & Tushman (2013) and the dual-operating system from Kotter (2012), we connected the two organizational structures and portrayed how the different IT artefacts trigger mechanisms enforcing this dual-structure.

- Our main finding is a logical inference of the mechanisms being triggered in the IS simultaneously, in which the system morphs into a dual-IS now supporting a stable hierarchical structure and a more agile network. We label it *the dual-IS.*

3.2.7 Summation of results from phase 2

How does the socio-technical perspective – in theory – acknowledge new phenomena?

In paper 4, we found that the socio-technical perspective looked at one instantiation of a socio-technical system pertaining to one work system, one group, one task, one technology at a time. We concluded that this narrow focus would be blind to either fit/misfits in the individual-technical relationship or consequential fits/misfits at group and organizational levels. Thus, a double-level view could acknowledge the dynamic forces set in motion by SMC by the individual, and it could acknowledge consequences in the social-technical system.

We found that aspects of unpredictability, situativity, improvisation and individuality transformed the reciprocal relationship between people and technology profoundly. We concluded that a perspective would only be rendered valuable if it acknowledged these aspects and the two levels in a system.

In paper 5, the rising complexity caused unpredictability. This challenged some of the other assumptions underlying the socio-technical perspective. Predominantly, intentional changes originating from managed design and implementations portrayed as a linear belief of how technology implementations would lead to institutionalization of behaviors and socialization to norms and values. While others criticized the separation ontology between what is technical and what is social, we identified that the separation ontology was important and a way to simplify complexity.

We concluded that the perspective *per se* exhibited a narrow focus on one work system. Complexity arising from the dynamic effects between different work systems and work practices in the organization would not necessarily surface. The present socio-technical system perspective did not fully acknowledge the malleable nature of SMC with unpredictable outcomes such as fluid network formations, and it showed a linear approach to outcomes, epitomized as technology's institutionalizing and socializing powers of group behavior.

However, the separation ontology between what is social and what is technical acknowledges that, to deal with complexity, we need ways to simplify reality. Keeping the separation ontology is important to make a distinction between what is individual, what is social, and what is technical.

We needed more knowledge on those basic mechanisms that drive change, outcomes and joint optimization in the workplace.

Thus, we turned from describing phenomena to critical realism (CR) as the philosophical background in paper 6. Looking for social mechanisms as the cause of outcomes in a social system could carve a way through the complex set of dynamics between new phenomena derived so far.

- We derived a set of historically reliable social and socio-technical mechanisms in order to explain outcomes. These mechanisms were institutionalization, socialization, individualization, diversity and integration.
- We inferred the mechanism of individualization to be triggered by technologies belonging to the meta category of generative IT artefacts, with features of unpredictability, improvisation, situativity and individuality producing diverse and productive outcomes. However, institutionalization, socialization and integration were triggered by Enterprise IT artefacts, denoting features of predictability and stability.

- When taking a holistic view of the entire organization, we made the logical inference that the two types of IT artefacts would exist in any IS at the same time, thus triggering different mechanisms and outcomes simultaneously. Individualization can be seen as clashing with socialization, but due to social mechanisms' dialectic dynamic nature of responding and combining, they can also work in harmony. Sometimes, they halt each other's processes, and sometimes they can complement each other, moving the entire system forward in an evolutionary way.
- We made a logical inference that the socio-technical system responded by a process in which institutionalization from certain technologies enables socialization that integrates people; this in turn enables individualization that diversifies people enabled by other types of technologies. We surmised that this could cause the socio-technical system (now seen as an entire organization) to morph into a dual-IS of two different but facilitating structures, that of a hierarchy and that of a network.
- We found that the dual-IS could in theory deliver system outcomes of both instrumental and humanistic objectives. The dual-mechanisms, when properly triggered, could change the system in an evolutionary and self-organizing way.

Reflections on phase 2 – SQ 2

In terms of contributing to how socio-technical change is achieved under the sway of technological individualization, we found it productive to analyze mechanisms, first in the original socio-technical perspective, and then compare them to the mechanisms now revealed in our theoretical explorations. However, an initial answer took form. Institutionalization and socialization in groups in the original socio-technical system seemed to be a core tenet in the socio-technical perspective.

In the light of the findings of other mechanisms and the many aspects of individuality, unpredictability, malleability and situativity from new SMC technologies entering the workplace, this focus needs reconsideration. From this follows that also planned and managed socio-technical change needs to be reconsidered.

We decided to make another round of empirical data collection to examine how socio-technical change is achieved in the current workplace.

3.3 Phase 3 and sub-question 3

SQ3: *How have mechanisms changed, and what are the implications to socio-technical change theory?*

Answering this question drove new empirical and conjectural research. The aim was to provide knowledge and new insights from the empirical and actual layer of events in the contemporary workplace. The aim was to generate more substantial conjectures of social and generative mechanisms *at work* in the socio-technical system. We wanted to solidify and extend the descriptions of new phenomena made from empirical observations in phase 1 (now almost two years after) and to test the theoretical assumptions made in phase 2 about the shortcomings of the socio-technical perspective and the suggestions to changes made so far. In particular, the triggering of technological individualization as a new mechanism in the system needed empirical backing.

Over the winter 2016/2017, we conducted 18 video Skype interviews with interaction workers working as consultants and salespeople in global and virtual organizations.

3.3.1 Revising the Socio-technical Perspective for the 21st Century: New Mechanism at Work. IJSODIT

We responded to a call from HICCS 2017 in the track of organizational dynamics and socio-technic. We asked: *How does the range of new technological affordances affect the relations between individuals within the organization? How does it change the mechanisms in the socio-technical system?*

The paper was fast-tracked to the International Journal of Social and Organizational Dynamics and IT, in which it is accepted, date pending.

Revising the Socio-technical Perspective for The 21st Century: New Mechanism at Work

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Richard Baskerville, Georgia State University, US, and Curtin University, Australia

ABSTRACT

A predominant understanding in information systems research is that technology has institutionalizing and socializing effects in its interaction with humans in the human enterprise. This understanding no longer gives a full account of the dynamics in the current workplace. Through a critical realist approach, the socio-technical mechanisms in the 21st century global enterprise are re-explored through a study of 18 users' productive behavior afforded by Unified Communication and Collaboration (UCC). The study finds that the mechanism of individualization is the cause of events that profoundly change the socio-technical reality. Individualization affects how people relate to one another and reduces the influence of the organization as a system. The power of individualization creates a new parallel structure of small networks of close colleagues. The study shows the dialectic nature of mechanisms in a socio-technical system and provides a social system perspective of the dynamic individualization forces that now inhabit the self-organization of a complex socio-technical system.

KEYWORDS

Socio-Technical Perspective, Critical Realism; Mechanisms, Unified Communication and Collaboration, Individualization, Socialization

Results

The aim of the research behind the paper was to explore the impact of individualization in the current workplace and how the apparently more individualized individual – as opposed to the more socialized individual – would influence the IS in the 21st century.

- We found a gap from literature using a socio-technical perspective. Users were framed as social individuals and not individuated individuals.
- We confirmed that the socio-technical perspective holds a notion of how social individuals are under the influence of institutionalization, socialization, routinization and structuration processes in their interaction with technology.

- Essentially, turning our view towards the individualized individual as opposed to the socialized individual revealed dynamics not revealed before in a socio-technical perspective. We found outcomes that could be caused by the mechanism of technological individualization.
- We inferred that SMC technology in the form of UCC afforded individual productivity as the upper-level socio-technical affordance from UCC. Through UCC, the goal-oriented actor was afforded control of flow, time, place and pace of interactions and information; when and how to socialize and with whom. The goal-oriented actor took individual responsibility for productivity and cut down on anything not seen as value adding. Simultaneously, this actor created new routines that were seen as value adding. These routines were highly individualized.
- We found that the impact of individualization reduced the influence from the processes of institutionalization and socialization as a collective process. Individualization influenced how the individual routinized and structured work individually.
- We now explain how mechanisms have changed. The present study found that individualization now plays an equally important role as institutionalization and socialization in the socio-technical system in the 21st century enterprise. This duality has not been studied from a socio-technical system perspective previously.

Reflections

We could now explain the occurrence of some of the outcomes from the previous studies of interaction workers in phase 1. We saw that the individuated individual in control of information streams, time, pace, interactions, relations, location, etc. as caused by the mechanism of individualization shed light on some of the issues experienced with SMC in paper 1: producing individual productivity, by balancing autonomy and the experienced fits at the individual level. Additional findings from phase 2, such as the emerging formation of virtual personal networks operated by the individual, were likewise supported.

However, we had focused on only one application (UCC) belonging to the generative IT artefact category with SMC technologies. We still needed to look more holistically at the dynamic relationship between the sub-set of IT artefacts embedded in an organization.

From phase 2, we knew the simultaneous existence of IT artefacts with different purposes supported either the social side of structure or the individual side of structure. They also supported strict processes and individual practices. Individuals operated on a regular basis in these dual-structures. We needed to look more into the equal balance between the social and technical and – now the individual – to explain socio-technical change. Likewise, the individual balance between maximizing and minimizing autonomy needed more empirical data. Finally, interlinking these outcomes with a clarification from the layer of mechanisms, triggered by the enterprise IT artefacts and generative IT artefacts, needed empirical backing.

We designed a third round of data collection to analyze outcomes and mechanisms in settings with both types of IT artefacts. We conducted the data collection in July/August 2017.

3.3.2 The digital individual – the changing nature of knowledge creation, IFIP 9.1 pre-ICIS 2018

We responded to a highly relevant call from a pre-workshop event in connection with ICIS 2017 from IFIP 9.1. The call focused on the changing nature of work. We hypothesized on how the individuated individual (now a new and useful concept in our research) in theory would alter knowledge creation. We asked how the digital individual changes the knowledge creation cycle. We discussed the paper at the workshop in connection with ICIS 2017, in December, Seoul.

The Digital Individual: Changing the Nature of Knowledge Creation

Research-in-progress
Louise Harder Fischer

Introduction

A related consequence of the internet's transformational effects (Castells, 2014) is that organizational hierarchy falls in favor of a flatter and more responsive, agile and networked enterprise (Rainie & Wellman, 2012; McAfee, 2009). In the digitally connected world, the individuated individual takes center stage (Castells, 2014) and becomes the focal operator in a network enabled by cloud, mobile and social platforms (Rainie & Wellman, 2012). Inspired by – in part – Hemsley and Mason (2013), we believe that the dominant Knowledge Management (KM) paradigms and models are "ill-suited for the knowledge environment facilitated" (Hemsley & Mason, 2013, p.139) in today's enterprises. In this paper, we *problematize* one of these paradigms – the life cycle paradigm; and the model of knowledge conversion from tacit to explicit knowledge in the form of socialization, externalization, combination and internalization. This model is known as the SECI model and was introduced by Nonaka (1991) and later epitomized in the book by Nonaka & Takeuchi (1995). These works are by far the most cited works in KM. The article has been cited 11459 and the book 42932 times, as of 15 November 2017. We suspect that the digital individual fundamentally makes changes to the knowledge creation and learning patterns *per se*, and that these changes eventually challenge the assumptions from which a prominent body of literature within the discipline of Information Systems (IS) and KM are built, from now of IS/KM. According to Newell (2015), Nonaka's thinking and associated accounts of the most effective ways to transfer different types of knowledge (explicit and tacit through repository or network KMs respectively) have been used in the IS literature (Newell, 2015).

Results

We concluded that the SECI model, at least in its traditional conception, was ill-suited for the present knowledge environment. Socialization and internalization were diminishing, while externalization and combination through personal controlled knowledge flows were increasing but never reaching the organizational level in its traditional understanding.

- The work added aspects to an understanding of how knowledge creation, as a consequence of technological individualization, changes from being oriented towards organizational combination to being created and distributed more in personal networks.

Reflections

In the light of the findings from our previous studies, the exploratory exercise in paper 8 was both relevant and timely. In paper 2, we had observed negative impact from behaviors with SMC on socialization at the workplace, hindering informal knowledge sharing in day-to-day practice. In paper 5, we derived that individuals increasingly organized into networks of individuals, rather than embedded in groups, which affected the organizational knowledge-creation process. It became too fragmented and personalized. In the study behind paper 7, we had found that technologies of connectivity afforded individual formation of smaller personal networks and individually controlled knowledge streams. Thus, we found it valuable to understand

new knowledge-sharing patterns related to the common perceptions depicted in the SECI model (Nonaka, 1991).

At the same time, we responded to a new call from ECIS 2018 with the theme of "Beyond Digitization – New facets of Socio-technical Change." From our prior studies, we had evidence that the stable balance between the social and technical sub-systems through institutionalization and socialization did not explain the balance – *if any* – in the systems we studied. We needed to study the concept of socio-technical change, as aiming at balance or equilibrium, more closely. We also wanted to inquire into a socio-technical setting, looking at two groups of IT artefacts simultaneously.

We made a larger review of socio-technical change theories pertaining to the concept of equilibrium, and we finalized the analysis of the e-group interview with 11 respondents.

3.3.3 Socio-technical Change: The Equilibrium Paradox, ECIS 2018

We responded to the call from ECIS 2018. The main theme "Beyond Digitization – facets of socio-technical change" epitomized the relevance of our research focus. It would also provide us with an engaged and experienced audience. We asked: *How do platform-based organizations achieve socio-technical change?*

SOCIO-TECHNICAL CHANGE: THE EQUILIBRIUM PARADOX

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Research paper

Abstract: In the domain of change and information systems (IS), we have persisted in the assumption that a well-functioning IS exhibits a balance between the social and the technical structures such that this system rests in a state of stable equilibrium. When transformational change arises, the system falls into a state of disequilibrium, until it reaches a new state of equilibrium. This assumption no longer gives a full explanation of the complex dynamics in today's enterprise. In this paper, we explain the concept of unstable equilibrium that results from the continuous change that individuated individuals make in socio-technical structures. Our findings arise from a critical realist perspective used to interpret data from an e-group interview with 11 professionals working in platform-based organizations. We find that a generative mechanism of contradictory complementarity, denoted as individualization and socialization, now inhabit the IS and causes outcomes that are both individual-technical and socio-technical. Now change happens in the surface structures resting in unstable equilibrium, while the deep structures remain in stable equilibrium. This *equilibrium paradox* in socio-technical change explains how platform-based organizations change by both achieving agility from their IS while simultaneously achieving stability.

Keywords: Socio-technical change, platform-based organizations, generative mechanisms, contradictory complementarity, individualization and socialization, equilibrium paradox

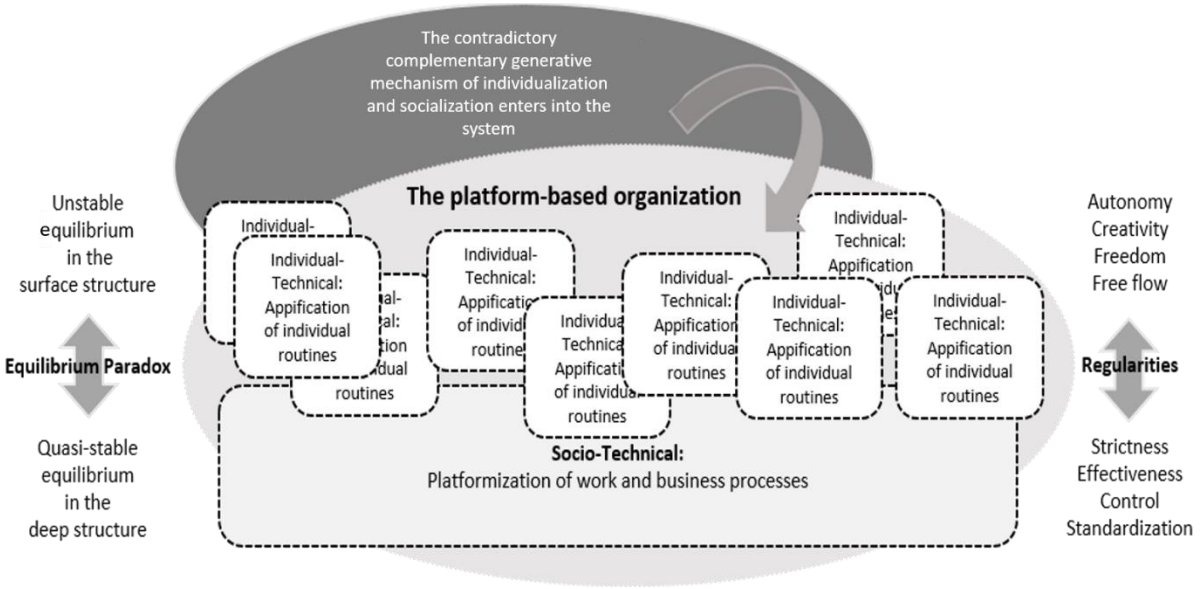
Results

Figure 3, the equilibrium paradox is the result from paper 9. It shows the complex nature of socio-technical change.

- It provides a social system perspective of the dynamic forces set in motion by the dual-mechanism of individualization and socialization. These forces now inhabit the self-organization of a complex socio-technical system.
- Change in this system is not a linear process of long periods of equilibrium, punctuated in a revolutionary manner, restoring to new equilibrium. Instead, it is influenced by the dual-mechanism that triggers regularities (up and down arrows, in figure 3) between individual actions and social relations, denoting features of autonomy/strictness; creativity/ effectiveness; freedom/control; free flow/standardization.

- The concept of improvisation is imperative as a key feature in the surface structures, inhabited by SMC technologies and individuated individuals. In figure 3, this translates to *appification of individual routines*. However, the deep and stable structures are enforced by enterprise IT platforms inhabited by social individuals. This translates to *platformization of collective business processes* in figure 3.
- The surface structures rest in unstable equilibrium, constantly changing and transforming, however, deep structures rest in quasi-stable equilibrium.
- We found that the main narrative of socio-technical change as a process of long periods of stability, then punctuated and restored, no longer holds.
- The equilibrium paradox in socio-technical change explains how organizations achieve change by both achieving agility from their IS while simultaneously achieving stability.

Figure 3. The Equilibrium Paradox



Reflections

We found patterns and tendencies that could be caused by individualization and institutionalization, working together, causing different outcomes at two levels: the individual-technical and the socio-technical, predominantly jointly optimizing the entire system. A key concern in the empirical data was how to control, access and maintain high-quality data and information. Data, information and knowledge were essential to both individual productivity and organizational efficiency. The individuated individual acted as a social individual accepting standard workflows at the social-level of structures, even though it minimized autonomy. However, access to high-quality information from the surface structures with SMC increased individual productivity and autonomy. We saw tendencies at the socio-technical level and the individual-technical level influenced by the regularities in between the levels, holding features of a balance between autonomy/control and free/strict modes of work. This can explain a new form of socio-technical change as evolutionary and not revolutionary.

We succeeded in maintaining the separation ontology by developing an analytical lens that provided us with a *both/and* view. First, analyzing both types of IT artefacts, i.e. enterprise IT and SMC technology, at two levels: the individuated individual with technology and the social individual with technology. Looking at tendencies in these levels and regularities between the levels revealed the existence of the dual nature of mechanisms,

now labeled as one dual-mechanism, by nature contradictory complementary. This mechanism triggered regularities between the levels, each holding sequences of socialization triggered by enterprise IT artefacts and individualization, triggered by SMC technology. We saw the dual-structure organization as a system response, in which improvisation was evident as a key feature. The findings were a result of looking at a layered reality and relations between levels. It revealed a new change dynamic not revealed before. Our findings supported our main suggestions of change in the socio-technical perspective from phase 2.

3.3.7 Summation of phase 3

How have mechanisms changed, and what are the implications to socio-technical change theory?

We can now explain how mechanisms have changed. The present study found that individualization plays an equally important role as socialization in the socio-technical system in the 21st century enterprise. We found that it fundamentally changes how we understand socio-technical change.

We found that individuated individual behaviors with SMC technology alters the knowledge creation cycle, rendering it much more personal, networked and distributed, affecting organizational knowledge creation and knowledge sharing. This supported our prior results of transformative powers from individualization to organizational structures.

We can now conclude that a central feature in the 21st century enterprise is that socio-technical systems change at two levels: the individual and the social level; and at the surface of structures and deep structures. These changes are the result of outcomes from IT artefacts that trigger the dual-mechanisms of socialization and individualization that assist in producing outcomes on both levels. This change is evolutionary and emergent in nature. Socio-technical change now happens in the dynamic evolutionary process in which a central concept is a paradoxical equilibrium of instability and stability that provides both agility and predictability as visualized in figure 3.

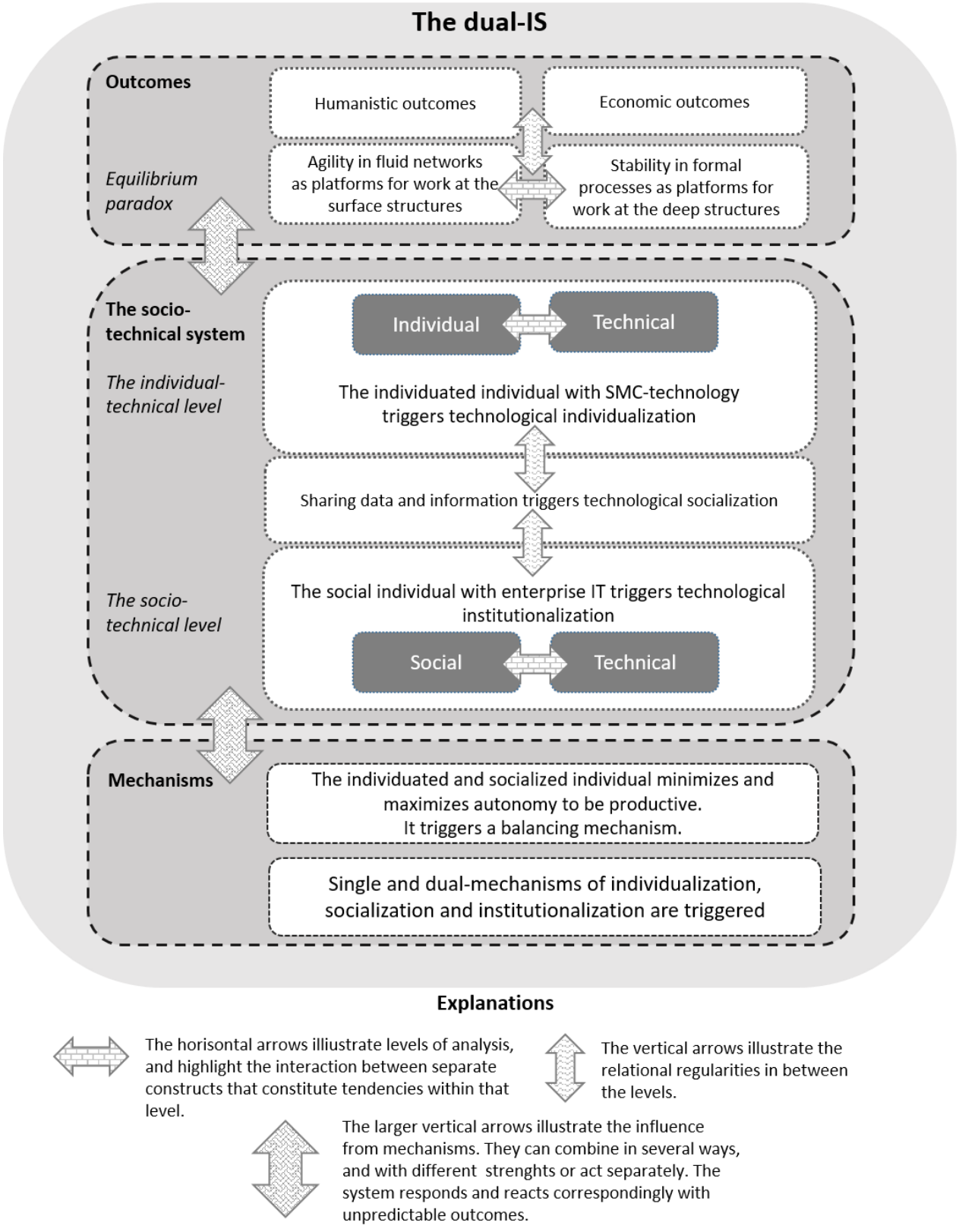
We conjectured the possible existence of contradictory complementary mechanisms i.e. dual-mechanisms, that, if properly triggered, would enable sequences and tendencies of both stability and agility. This could most likely turn into resilience and elasticity in the system.

3.4 Overall result

How is socio-technical change achieved under the sway of technological individualization?

Based on the answers of each SQ and the results from the research papers, we draw an overall framework that explains the complex process of how socio-technical change is achieved under the sway of technological individualization. This section answers the main RQ. Figure 4 is a graphical representation of how we can portray how socio-technical change is achieved. We call the model the socio-technical change framework. The framework illuminates three domains in three grey square boxes: mechanisms, the socio-technical system and outcomes.

Figure 4. The socio-technical change framework



The vertical larger arrow with braided pattern signals that any combination of mechanisms will influence the systems and hence the outcome. The middle grey square is the socio-technical system, now as a two-leveled reality. The socio-technical level and the individual-technical level each constitutes two separate constructs. The separation between the constructs are for analytical purposes. Analysis will reveal tendencies in the relationship between the individuated individual with new technology and the social individual with new technology. This is important to explain the change processes within each level. At the individual level, we found tendencies denoting features of improvisation, molding, testing, experimenting and fast-changing practices to be productive with SMC. At the social level, we found tendencies denoting features of the social individual submitting to standard processes and automated workflows with enterprise IT. SMC and enterprise IT each trigger a socio-technical mechanism of technological institutionalization and technological individualization that sets in motion a sequence of events within the system.

Technological individualization as an example causes the users to take control of time, pace, place and information streams. Relations and organizational structures are re-arranged, and users organize fluently around personal virtual networks. Technological institutionalization, on the other hand, is the externalization of a certain function or process that is objectified in the technical system. This sets in motion a process of generalization of value and behavior patterns in the system.

The mechanisms (in the bottom grey area) are now activated. This triggers the balancing mechanism of how the individual minimizes and maximizes autonomy to stay productive. The single mechanisms are likewise triggered. If they combine into dual-mechanisms, they explain the cause of sequences happening simultaneously, as the regularities in between the levels in the socio-technical system visualized with the vertical arrows with wave patterns. The vertical movement predominantly signals the simultaneity of changes happening at different levels. The simultaneity of these changes can be analyzed in terms of how they create a regularity of change as an evolutionary process that moves the system forward. The outcomes are dual-structures of fluid network formations and stable structures. We label it the dual-IS with both economic and humanistic outcomes. *The regularities* are caused by the dual-mechanism (from the bottom square) that influences individual actions and social relations enacted by an individual who is *both* individuated *and* social. The response is a dual-IS on which the business operates. It rests in an equilibrium paradox. These structures enable each other and establish a system of resilience and elasticity.

However, the logical inference is that if a single mechanism is triggered forcefully, the balance is skewed, and the enablement of the dual-structure is now halted. Now, mechanisms might activate to work against each other to minimize the effects from either one. We surmise that this is the case in these few situations in which people from our case studies stop complying with strict policies and instead use rogue technology. In these scenarios, the system can turn into a loose uncoordinated and undirected network or into a strict and rigid hierarchy. In any case, neither the humanistic nor the economic objective is met.

In figure 4, we have illustrated the shared resource of data and information as a potential trigger of socialization. Interacting with, controlling, sharing and creating data and information (human or digital) was imperative to productivity in the case studies. We make the logical generalization that data and information, when seen as a shared resource, i.e. a commons, now trigger a process of socialization denoting shared values and perceptions of the importance of collective data of high quality. This also enables individual harvesting.

The above description and visualization are the answer to the research question of how socio-technical change is achieved under the sway of technological individualization. It now draws on the notion of a dual-IS that triggers dual-mechanisms with individuated and social individuals operating in a relational and layered reality. The outlay reveals the complex dependencies and dynamics in socio-technical change in a simplified manner. In section 5, we synthesize the contributions we have made. We address specifically how the research extends and elaborates on related and relevant IS theories and to the practice field. Then, we sum up on how to re-consider the socio-technical perspective under the sway of technological individualization. We now turn to the methodology section.

4. Methodology

This section explains the methodological path followed and acts as an account of the choices taken during the research project. The methodology section aims at documenting the rationale and the process behind the research design, data collection and data analysis used in three different studies. Table 2 is a detailed overview of the methodological choices taken in each paper. It highlights the paradigm, method, study design, data collection, techniques, main theories addressed, literature domain reviewed and the type of paper.

The methodology section is presented as a natural history (Silverman, 2013, p 355). It begins with a description of the chosen paradigm. According to Walsh et al (2015), a paradigm is the system of beliefs and practices shared by a group of people. This thesis shares the beliefs of the critical realism paradigm, which holds a positivistic ontology and constructivist epistemology. However, we started out with a phenomenological approach. As will be explained, these approaches complement each other. After the paradigm section, we elaborate on the methods chosen to study the phenomena and the underlying mechanisms behind these phenomena. According to Walsh et al (2015), a method is the data collection methods used in a research project. We will elaborate on the techniques and frameworks that helped to make sense of data.

4.1 Paradigm

The philosophical framing of the final proposed research is CR derived from the understanding laid out by Roy Bhaskar (2008) and Margaret Archer (2014, 2015). More specifically, critical realists believe in the dualism of actor/structure and in a two-level reality of an intransitive character (the natural world) and a transitive character (the social world). In CR, the reality exists out there (the intransitive level) and it is independent of the observer. As such, it leans on positivism, and the position that there is a truth. The structures in the intransitive level are important for the social actor but do not constitute the actor: they give the actor certain possibilities and limitations, leaving something to the actor him or herself (Archer, 2015). To critical realists, the reality is deep, thus consisting of both phenomena and observations (the empirical domain in the layer of the transitive) but also of objects, entities and structures (the domain of the real; the intransitive layer). The domain of the real is not easily accessible. The logic is that mechanisms and structures create events (the domain of the actual in the layer of the transitive) that observers can study (through the domain of the empirical). These observations are in nature subjective. As such, it leans on constructivism. It is about deep understanding of phenomena that can reveal the structures and mechanisms of the real. This view and logic fit well with the purpose of re-considering the socio-technical perspective. First, it gives a possibility to explain how socio-technical change is obtained, and how the socio-technical system responds to mechanisms such as individualization. It can provide the basis for answering the question: how is socio-technical change obtained under the sway of (the mechanism) technological individualization?

In figure 5, we have pictured the relationship of the three domains in CR that constitute the two layers of reality: the transitive layer – the domain of the real (the outer circle) and the intransitive layer – the domain of the actual and the domain of the empirical – (the two inner circles). The dotted circles represent in which layer the papers reside.

#	Para-digm	Method/study design	Data collection	Techniques	Main theories addressed	Literature reviewed	Type of paper
1	Phenomenology	Two critical comparitative case studies	E-group interviews (8 people) Group interview (6 people)	Interpretative Hermeneutics Open and Directed coding	Autonomy Paradox (Mazmanian et al, 2013) Autonomy – Productivity relationship (Drucker, 1999). Selection, adoption and exploitation of different types of technologies (McAfee, 2006)		Full research Access: http://www.forskningsdatabasen.dk/en/catalog/2303190564 Included in appendix #1
2	Phenomenology	Critical case study	1 Single in-depth interview	Interpretative Hermeneutical Directed coding	KITA framework (Cabitza & Locoro, 2014) Process and Practise (Goffee & Jones, 1996) Tacit and explicit knowledge (Nonaka et al. 2010)		Research-in-progress. Short paper. Included in appendix #2
3	Phenomenology	Critical case study	Used prior data	Interpretative Critical Hermeneutics Re-analyzed prior data	OCEAN personality traits and knowledge sharing (Zelaya, 2015) SECI Model (Nonaka & Takeuchi, 1995) Personality and Individual Differences, Influence strategies (Alkış & Temizel, 2015) Persuasive system design (Oinas-Kukkonen & Harjumaa, 2009).		Research-in-progress. Short paper. Access: http://ceur-ws.org/Vol-1582/4HarderFischer.pdf Included in appendix #3
4	Phenomenology	Theoretical, conjectural conceptual	Selected theories	Critical Assessment Interpretative Conjectural	Socio-technical perspective (Sarker, Chatterjee & Xiao, 2013) Networked Individualism (Rainie & Wellmann, 2012) KITA framework (Cabitza & Locoro, 2014)		Short paper. Discussed in group H at IRIS 2016. www.2016iris.org/program/groups/ Included in appendix #3
5	Phenomenology	Theoretical conjectural conceptual	Selected theories	Critical assessment Interpretative Conjectural	Consequences on working with social, mobile and cloud (Von Krogh, 2012; Newell, 2015) Complexity Theory (Ang, 2011) Socio-technical perspective (Sarker, Chatterjee & Xiao, 2013).		Discussed in group H at IRIS 2016. www.2016iris.org/program/groups/ Included in appendix #5
6	Critical Realism	Literature review	Systematic search	Critical assessment Interpretative Directed coding	Socio-technical Mechanisms (Ropohl, 1999) Autogenic mechanisms (Hofkirchner, 2015; Hofkirchner, 2014)	23 papers theorizing contributions of the IT artefact phenomenon from 2001-2016	Full research paper. In PACIS 2018, conference proceedings. Included in appendix *#6*
7	Critical realism	Exploratory Critical Case study Theory develop-ment	18 single-in-depth interviews over skype with video. Convenient sampling from LinkedIn	Grounded theory approach (Walsh et al 2015) open and theoretical coding using Nvivo Affordance approach (Bygstad, Munkvold & Volkoff, 2016)	Individualization (Castells, 2010; Baumann, 2011) Socio-technical mechanisms (Hofkirchner, 2015; Hofkirchner, 2014)	Systematic literature search of literature pertaining to the individual in papers holding a distinct socio-technical perspective. 16 papers	Full research paper. In International journal of social and organizational dynamics. *Accepted - pending publication date. Included in appendix 7, courtesy of the journal.*
8	Critical ontology	Literature study	Key texts most cited criteria	Problematization (Alvesson & Sandberg, 2011)	SECI-model (Nonaka, 1991)	Former and present KM/IS theories such as Alavi & Leidner (2001) and Newell (2015)	Short paper. In booklet from IFIP 9.2. Changing Nature of Work. ICIS 2017, Seoul. Included in appendix 8
9	Critical realism	Critical case study	E-group interview 11 participants Convenient sampling from LinkedIn	Hermeneutical approach (Butler, 1998). Developed a three-step analytical method looking for con-com mechanisms (Donati, 2015). Directed coding	Socio-technical change as punctuated equilibrium (Lyytinen & Newman, 2008) Deep structures (Wand & Weber, 1995) Platform Organizations (Ciborra, 1996)	Systematic and snowball literature search. 33 papers reviewed on socio-technical change.	Full research paper. In proceedings of ECIS 2018. Included in appendix 9

Table 2. Overview of methodology in each paper

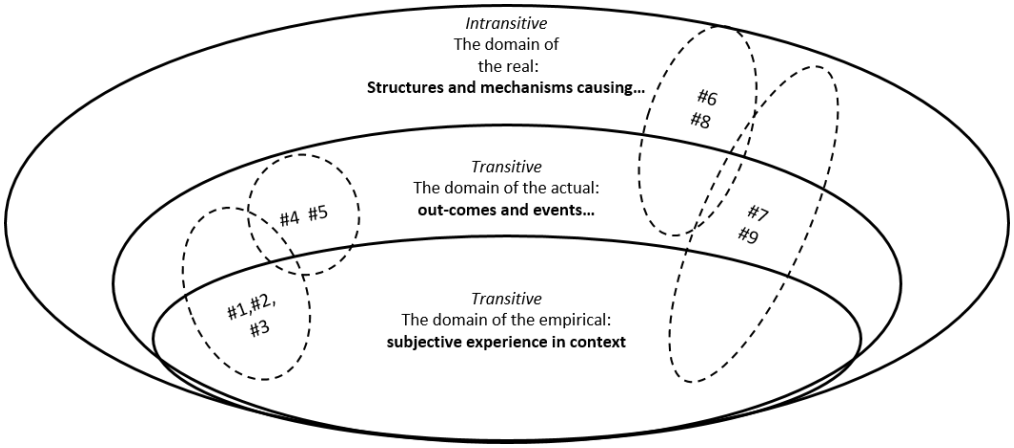


Figure 5. Three layers in critical realism

When inquiring into events and outcomes as phenomena, as we did in papers 1-5; then the structures and mechanism that cause these events (now seen as patterns and sequences), as we did in papers 6-9, the division of reality in CR provides a suitable philosophical and ontological framing. This gives us a possibility to explain socio-technical change based on knowledge of how socio-technical systems change in the contemporary organization and the mechanisms that most likely cause these events. Eventually, this gives us an opportunity to answer the main RQ.

CR lends itself to both quantitative and qualitative research. We have chosen a qualitative and explorative approach. The main RQ asks *how* and the sub-questions ask how and *what*. This entails uncovering phenomena that are not known. This entails exploring aspects of the phenomena and what leads to the phenomena. Qualitative research can be positivistic, interpretive or critical. We have chosen the interpretive approach. In figure 5, the nine papers are placed onto the ontological layers in the critical realist position.

First, in phase 1, we analyzed the phenomenon of interaction workers enabled by SMC technologies in two different settings of knowledge work – co-located and distributed. These studies were based on a phenomenological approach combined with hermeneutics to interpret meanings. In the realm of CR, this could be translated into describing and interpreting events trough the empirical. Phase 1 thus constitutes research in the transitive level. Phenomenological research is descriptive and focuses on the structure of experience, the organizing principles that give form and meaning to the live world. It seeks to elucidate the essences of these structures as they appear in consciousness – to make the invisible visible (Laverty, 2003). Phenomenology is about researching phenomena and how the particular phenomenon appears from a first-person perspective. This is in nature descriptive. To interpret the descriptions, a hermeneutical approach was applied. Hermeneutic research is interpretive and concentrated on historical meanings of experience, their developmental, cumulative effects on individuals and social levels (Laverty, 2003). Hermeneutics was used to interpret phenomena through the meanings that the respondents assigned to them (Klein & Myers, 1999). We applied a pragmatic/constructivist hermeneutical approach to interpretation. According to Butler (1998), this entails entering into the interpretative norms of a community in which meaning operates and is to be found within the historical contexts of the interpreter and interpreted (Butler, 1998). Like phenomenology, hermeneutic phenomenology is concerned with the life world or human experience as it is lived. The focus is toward illuminating details and seemingly trivial aspects within experience that may be taken for granted in our lives, with a goal of creating meaning and achieving a sense of understanding (Laverty, 2003). The approaches in round 1 draw on several concepts and techniques from phenomenology and hermeneutics, combined with conventional techniques of study design and data collection. The combination of both descriptive and interpretative approaches resulted in gaining a deeper understanding of the phenomenon of technological individualization, with aspects of productivity, autonomy, improvisation and unpredictability balance.

While the phenomenological approach reveals phenomena, it does not deliver an explanation. According to Glendinning (2008): "What the phenomenologist aims at, then, is not a theory of this or that phenomenon – a theory which would be characterized by its distinctive positions and extractable theses – but an effort to come reflectively to terms with something that is, in some way, already 'evident'. It is in this sense a work of explication, elucidation, explication or description of something we, in some way, already understand, or with which we are already, in some way, familiar, but which, for some reason, we cannot get into clear focus for ourselves without more ado" (Glendinning, 2008, p. 38). Real scientific explanations are not about describing phenomena but about explaining what causes phenomena.

The thesis draws on Roy Bhaskar's (2008) work. CR is relevant in the studies of information systems since it takes the studies from the empirical observable domain of the actual events and can lead to theorizing about the mechanisms causing these events. Moving between the different layers gives a platform an opportunity to analyze the causal aspects and to move within and between the empirical and theoretical understandings that emerge.

The ontological, epistemological and methodological coherence in the research is the following: In CR, the ontology is objectivistic, but the interpretations arise from social conditioning. The epistemology is constructivist; phenomena create perceptions, which are open to misinterpretation. Thus, the focus is on explaining within a context. Methodologically, the research methods were fitted to the subject matter.

To answer SQ3, we sought to explain the mechanisms that create certain events and outcomes in a socio-technical perspective. In the CR methodology, a mechanism is a causal structure that can trigger events (Bhaskar, 2008). However, at a more detailed methodological level to understand mechanisms is a bigger challenge. Mechanisms are unobservable (Bhaskar, 2008). The challenge is to provide a theoretical description of mechanisms that can explain the observed events. Thus, the methodological question is how do we identify mechanisms, since they are not observable (Bunge, 2004). "Mechanisms are a snapshot of those processes in the system in question that are peculiar to its kind. In turn, a process is a sequence of states; if preferred, it is a string of events" (Bunge, 2004, p.189). We applied these explanations and proceeded to interpret sequences and outcomes. We explain this in detail in section 4.3.

4.2 Empirical studies: study design and data collection

This section describes the approach in the empirical papers 1, 2, 3, 7 and 9. We conducted three rounds of qualitative data collection. Each and in combination, they now constitute a "collective case study, where a number of cases are studied in order to investigate some general phenomenon" (Silverman, 2013, p. 143). The data comes from single and group interviews with 48 respondents. We present the respondents in tables 3, 4 and 5 from the three data collection rounds.

Table 3. Respondents in first round

Case	Participants	Organization
Distributed work/Mobile workers	10 solution architects and consultants.	Global software company. + 124,000 employees.
Co-located work/Office workers	8 project managers from communication, IT and business (one follow-up interview was conducted with one of the participants)	Global engineering company. + 13,000 employees.

Table 4. Respondents in round two

#	Gen	Age	Industry/Size	Education	Position/Role
1	M	53	Software architect/124,000	Master	Manager/Sale
2	M	49	Business IT consultant/ +30	Master	Project Manager/New knowledge concept
3	M	45	Construction/+10,500	Master	Project Manager/ Office productivity
4	M	43	Hands-free tech/ + 5,000	Master	Project Manager/B-to-B communication
5	M	29	IT-consultant/ + 264,000	Master	Project Manager/Developing concepts
6	M	46	Ministry/+ 1,350	Master	Manager/Coordinating industry campaigns
7	M	29	Internal con telecom/+ 8,500	Master	Project Manager/ CEO-assistant
8	F	46	Marketing medico/+ 9,800	Master	Manager/Sales
9	F	32	Pharma/ +100,000	Master	Project Manager/Sales
10	F	45	Outsourcing consult. + 2,500	Bachelor	Project Manager/Sales
11	F	28	Accounting service + 200,000	Master	Project Manager/Branding recruitment
12	F	47	Energy/ +6,700	Bachelor	Project manager/Wind-mill projects at sea
13	F	42	Consulting IT-Outs./+ 260,000	Bachelor	Project Manager/Sales
14	F	47	Comm dep. pharma/+ 5,500	Master	Manager/Crisis and rep. management
15	M	35	Legal dep. telecom/+ 35,000	Master	Manager/Legal issues in telecom
16	M	43	Food cept dev/+ 335,000	Bachelor	Manager/New products for gourmet chefs
17	M	29	Consult. accounting +200,000	Master	Project Manager/HQ IT projects
18	M	47	Mobile technology + 220	Master	Manager/Sales and accounts new countries

Table 5. Respondents in round 3

19	F	27	Fintech/1	Master	Advisor/Managing customer relation
20	F	48	Education/ +7	Master	Consultant/Teaching
21	M*	30	Internal cons. telecom/ +8,500	Master	Director/Dev. automation of processes
22	M	40	Recruitment / +7	Master	CEO/Sales and stakeholder relations
23	M	47	Artificial Intelligence/ +30	Master	Manager/Sales and leadership
24	M*	54	Software architect /+124,000	Master	Manager/Sales and customer relations
25	M*	44	Food and Beverage/+335,000	Bachelor	Director/Concept developer
26	M	45	SW-Infrastructure/+6,000	Master	Consultant/Sales and customer relations
27	M	31	Architecture/ +400	Master	CIO /IT planning and implementation
28	M	42	Cloud service/wage/ + 13	Bachelor	CEO/Sales and stakeholder relations
29	F	46	Online shop consultant/1	Bachelor	Advisor/New online concepts

Legend: *Replicates from the round 2.

We used a critical case sampling technique (Flyvbjerg, 2006). It is particularly useful in exploratory research, where a small sampling can be decisive enough to explain the phenomenon of interest. This technique can help make logical generalizations (Flyvbjerg, 2006). We chose to interview individuals from different enterprises. We sought generalizability across cases sharing the same setting. We also looked for inter-subjectivity in e-group interviews.

The respondents thus came from different enterprises, sharing the setting of global and virtual enterprises in which knowledge work was enabled by SMC technology. We made a convenience sampling. In round one, we chose two groups of colleagues from companies based on professional relations. For rounds two and three, we posted a request on the author of this thesis' LinkedIn page (with +1200 contacts) in August 2016 and then again in June 2017. We asked for participation in research from people interested in the phenomenon *new ways of working*, a commonly used label of digital work-settings. Table 6 is an overview of the different data collection methods used and the amount of data material produced.

Table 6. Data collection methods and material.

Round	Data collection methods	Material: Amount and language
1	(a) E-group interview in a closed group on Facebook (distributed and mobile workers). Participants: 10 solution architects from the same team; 10 questions, during 2 weeks. Data used in 1# and #3. (b). Workshop on-site (8 office workers). Data used in #1, #2 and #3. (c) One follow-up video Skype interview with an office worker. Data used in #2.	a). 25 pages; coded; Danish. Examples below. b). 8 pages; coded; Danish. From post-its, on PowerPoints. c.) 9 pages, Danish.
2	(d). E-interviews with Skype and video. Participants: 18 different interaction workers from 18 different global organizations. Data used in #7.	d). 120 pages, Danish, analysis using Nvivo. Examples below.
3	(e). E-group interview in a closed group on Facebook. Participants: 11 different interaction workers from 11 different organizations. Data used in #9.	e). 20 pages, English, coded using word comments.
In Sum	Two types of qualitative data collection methods: Single interviews and group interviews. 19 single interviews using Skype and video. 2 e-group interviews using closed group on Facebook and one on-site face-to-face workshop.	183 pages of qualitative data. Open coding used in (a) and (e) Directed coding in (a) (b) (d) (e) No coding in (c)

4.3 Analyzing and interpreting Data

In this section, we present how we analyzed data in each of the three rounds. We used both open and directed codes to arrive at an answer to SQ1. This included hermeneutical interpretation. Table 7 and table 8 are examples of our coding from data.

Table 7. Examples of directed coding from e-group interview round 1

Question: What is a mobile worker?
"An employee who works productively without a fixed location"..."a knowledge passer, inspired from basketball, where the ball, i.e. information, shift hands all the time"…"a knowledge networker.. it is about the network that embeds the knowledge worker, with the many available channels, i.e. message, voice, video, mail, board used to exploit knowledge from others"
Codes: Productivity, free of location, knowledge, network

Table 8. Examples of directed coding from group interview in round 1

Question: When do you work productively?
"When I get time to concentrate, time that I decide, when it suits me" … "When I communicate and collaborate with my colleagues." "I work the best when I'm in collaboration mode, i.e. *always on*, until I decide to un-plug"
Codes: Freedom to choose; enabled by technology

From the hermeneutical interpretative approach in round 1, we arrived at a deeper understanding of important aspects and phenomena related to experiences with SMC in knowledge work settings. These are reported as results from phase 1 in section 3.1

In rounds 2 and 3, we proceeded with a CR approach. Coding, analyzing and interpretation were not trivial. Particularly in CR, it involves a very systematic and reliable approach. Trustworthiness, rigor and quality are paramount in any research, and as critical realists, there is a special obligation to validity and reliability when conjecturing mechanisms, since they are unobservable (Bhaskar, 2008). This leaves the explanation to the researcher and demands more visibility in argumentation and inferences along the way. Looking for mechanisms is not an easy task (Bygstad, Munkvold & Volkoff, 2016; Bunge, 2004). It takes iterations, a creative approach and critical thinking (Bhaskar, 2008). It is influenced by the researcher's thinking and capabilities. Conjecturing mechanisms that are not observable is difficult and lends itself to the risk of overinterpretation and bias from the researcher. The remainder of this section focuses on three distinct methods developed and applied for conjecturing mechanisms in a systematic and reliable manner.

Method of analysis in the literature review

In the literature review in paper 6, we experimented with a method for how to look for social mechanisms triggered by IT artefacts. First, we made a table of mechanisms (table 9). This we believe represents a historical and theoretical possibility of the mechanisms actually being real (Gross, 2009). We drew on literature from the techno-social domain, i.e. information society philosophy, socio-technical philosophy and sociology.

Table 9. Codes used to identify mechanisms in IT artefact literature

Socio-technical mechanisms and their outcomes	
Technical institutionalization. Technical socialization (Ropohl, 1999).	When the particular IT artefact theory and description of features displays effects/intentions of institutionalization and socialization i.e. shared ways of working.
Technical individualization. Technical diversity. (Castells, 2014; Baumann, 2011).	When the IT artefact denotes different outcomes, individualized behaviors and increased autonomy. When the IT artefact is malleable and denotes generativity.
Dual-mechanisms and outcomes	
Integration & diversity. Socialization & individualization (Hofkirchner, 2015; Hofkirchner, 2014).	When the particular IT artefact *theory* displays effects of the dialectic nature between integration, diversity, socialization and individualization.

We inferred, abductively, which of the mechanisms from table 9 most likely were reflected in the empirical and theoretical research papers describing IT artefacts in knowledge work settings. The 23 articles were a result of a systematic search in AIS eLibrary, Journal of Organization Science and Google scholar using the search terms "IT", "Information Technology", "Technology" + "Artefact" + "Artifact" from year 2001 and forward. We sought conceptual and theoretical descriptions of the IT artefact phenomenon, from which we could conjecture mechanisms. This was a difficult task. In table 10, we display how we carried out the analysis. We give four examples. Column 1 is the author. Column 2 is the distinct definition of the IT artefact (the theorizing part). Column 3 is the inference of the underlying mechanisms based on the features from the definition. This part is the most critical in the review. We sought to come up with the most likely explanation, hence conforming to abductive reasoning, an often-referred way of reasoning used in CR (Bhaskar, 2008). We were very aware of the risk of overinterpretation and bias from the researcher. We analyzed each paper accordingly and produced an appendix, attached with the paper (See appendix 6).

Table 10. Short description of conjecturing mechanisms from IT artefact theories

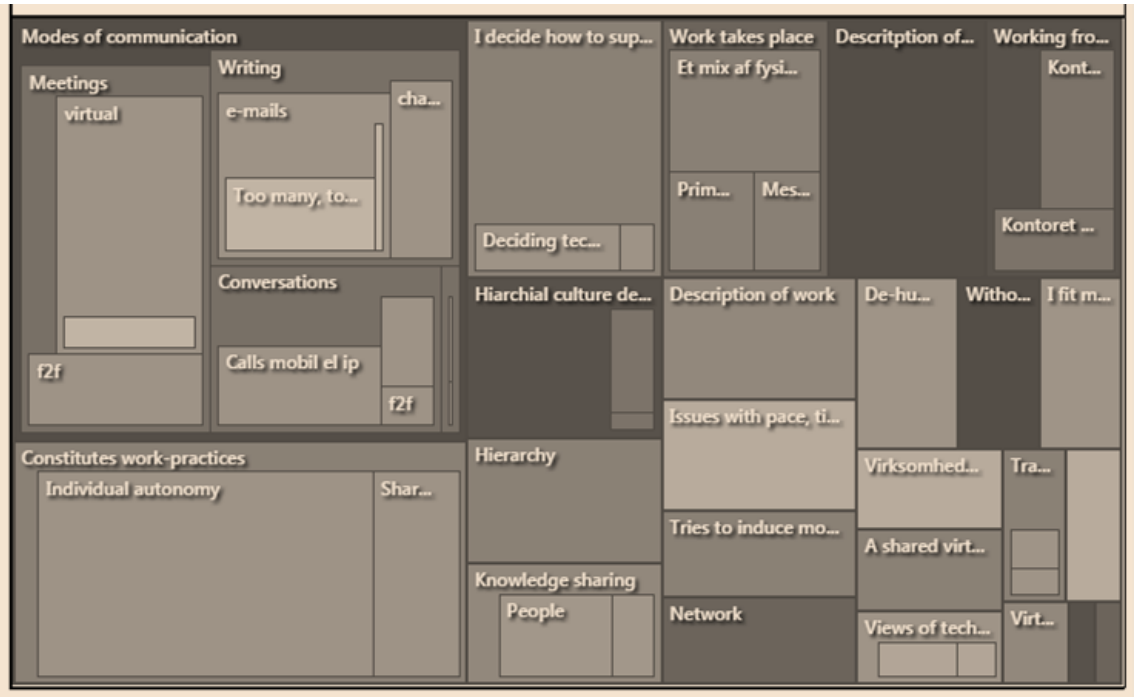
Author	Short version of the description of IT artefacts	Inference of mechanisms
Orlikowski & Iacono (2001)	The IT artefact is defined as: "bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software" (p. 121). IT artefacts possess characteristics: IT artefacts are not natural, neutral, universal or given; they are embedded in some time, place, discourse and community; they are made up of a multiplicity of often fragile and fragmentary components; they are neither fixed nor independent, but emerge from ongoing social and economic practices.	IT artefacts play a distinct/active role in an organization, this implies *technical institutionalization*. The IT artefacts emerge from a community, impacted by social and economic purposes from the conditioning context. This implies technical socialization.
Kallinikos (2002).	IT artefacts must be seen through a continuum of malleability and predictability. By understanding IT artefacts from this stand, the element of human agency in the workplace becomes a central focus point. It is promoted to look at IT artefacts as representing a sketch, a script or score for work. Logically, when being a score for work, little malleability is possible, while when introduced as a sketch, it opens up for human agency and local interpretations.	This view reveals the complex and dialectic nature of the basic mechanisms in socio-technical systems; technologies can lead to *institutionalization and socialization* but through individual interpretations they lead to diversity. This in turn depends on the degree of malleability and predictability inherent/chosen/presented in the technologies. Human agency plays a large role; thus the mechanism of *individualization* can cause outcomes.
Carroll (2008).	The IT artefact previously fixed in a specific physical context – from a single stranded design with a purpose – must be viewed from the perspective of the individual mobile worker, who constructs a portfolio of technologies. Diverse, unexpected and inconsistent use of technology and temporal orientation towards the situation, determines the portfolio in the moment.	We infer he causal powers from *individualization* on structures, i.e. the outcome of personal portfolios of technology to support mobile work. The use and appropriation of mobile technology is situational and contextual. This new reality reveals increased diversity in the work system, to cope with evolutionary cycles that speed up, increasing this diversity.
Evermann & Tate (2009)	The IT artefact (of various sorts) must be addressed much more specifically in relation to individual human psychology in order to create relevance at the operational and actionable level in an organization. A theory template for instantiating a specific IT artefact and a specific theory (related to the individual level of beliefs, adoption, selection and behavior) is developed. The template is based on the processes by which characteristics of the IT artefact (the affordances) lead to consequences that are relevant to an individual.	A design approach based on assumed causal powers from t*echnological institutionalization in combination with technological individualization.*

Then we proceeded to analysis of empirical data. In the analysis and interpretations related to SQ3, we used two slightly different methods of conjuring mechanism from coded data from the second and third round of data collection.

From the 18 single interviews, 120 pages of data was produced. We first applied techniques of grounded theory (Strauss & Corbin, 1997), and applied open codes using Nvivo 11. We made +30 codes. They were: meetings, email issues, pace, work, being in control, communications preferences, video, position on

technology, etc. We then selectively organized them into theoretical codes such as primary working structure, description of technological opportunities, individual preferences, modes of communication, etc. We used memoing techniques and visual graphs to gain deep understanding of the data and themes. Figure 6 is a visual map from Nvivo representing in quantitative measures how the codes and sub-codes represented the body of coded data.

Figure 6. Open codes and theoretical codes from Nvivo 11 analysis

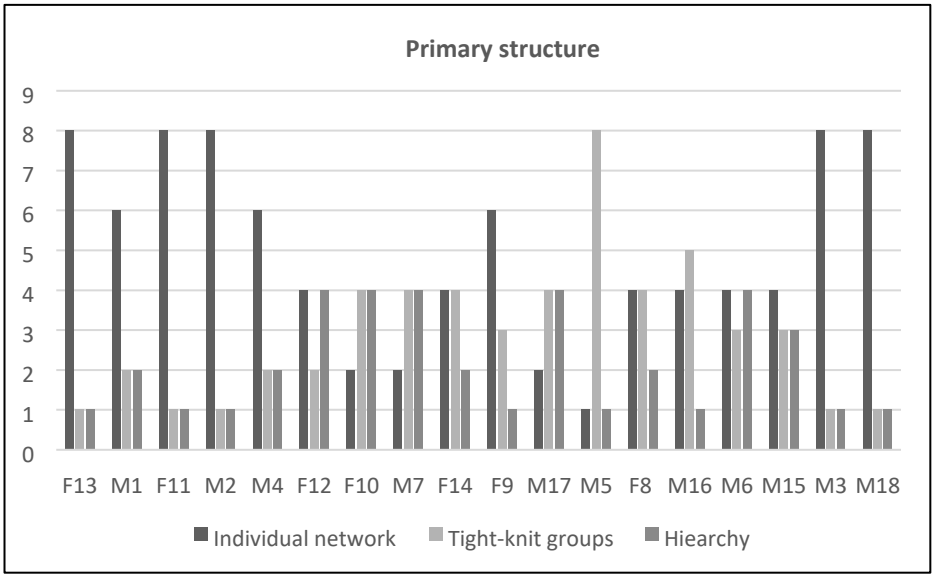


We identified central themes and tensions and labelled them: physical vs. virtual work; Experienced maturity with technology in the organization and as an individual; Individual vs. shared ways of working; Specific use of UCC (preference for chat, mails, video, etc.); Talking or Texting; Primary structure (individual network, tight-knit group, hierarchy) and the use of labels "I, we and them". Other themes such as productivity, speeding up time and autonomy were identified as constant.

We made graphical representations of all of these themes. Figure 7 is one of the visual graphs we produced. We gave each participant 10 points for each theme. We divided each theme into variables. Then we distributed the 10 points. This technique gave insight into patterns and made it easier to view and analyze the data. Figure 7 portrays the theme: Primary structure. We were interested in foregrounding the experienced primary structure of work in the setting. We made three theoretical variables. 1) Individual network, 2) Tight-knit groups, 3) Hierarchy. As an example, #13 (F13) from table 4 scored 8, 1, 1.

We saw a pattern of the primary structure being the individual network (in nine out of 18 cases). Tight-knit groups were observed in two out of 18, while hierarchy as the primary structure was observed in zero out of 18. However, in seven cases, there was a mix between the structures, not giving dominance to either one.

Figure 7. Graphical representation of themes from data.



Then we moved on to infer the level of socio-technical mechanisms, i.e. the relationship between a knowledgeable human and a technological artefact (in our case UCC) "as a meeting between a need and a capability, which allows for analysis at various levels" (Bygstad, Munkvold & Volkoff, 2016, p. 188). Affordances offered us an analytical bridge between the observed events, outcomes and the causal structure of mechanisms. It helped us to identify the socio-technical dynamics of mechanisms that are the possible interaction between human/social entities and technology. In particular, it allowed for a more specific analysis of the role of UCC (Bygstad, Munkvold & Volkoff, 2016). We define an affordance as "the *potential for behaviors associated by achieving an immediate concrete outcome* (that can be observed from the empirical, as an event) *arising from the relations between an object* (the IT artefact in question: UCC) *and a goal-oriented actor*" (Volkoff & Strong, 2013). We followed Bygstad, Munkvold & Volkoff's (2016) stepwise framework. See table 11.

Table 11. Stepwise analysis framework of affordances and mechanisms (Bygstad, Munkvold and Volkoff, 2016).

Step 1	Entails description of events.
Step 2	Is the identification of entities.
Step 3	Is theoretical re-description.
Step 4	Is retroduction it entails the identification of candidate affordances. This step has several sub-steps: a) Identification of immediate concrete outcomes b) Analysis of the interplay of human and technical entities c) Identification of candidate affordances d) Identification of stimulating and releasing conditions
Step 5	Analysis of the set of affordances and associated mechanisms.
Step 6	Assessment of explanatory powers.

This approach provided us with affordances such as possibilities to *withdraw from the physical socialized setting*; *fitting everything, to one self*; *taking control of a wide array of work-related issues: time, location, technology support*. As an example of step 4 a), we inferred different outcomes such as *virtual interactions as primary connections* and *operate a small network of people*. See tables 12 and 13.

Table 12. Outcome from affordance analysis

Virtual interactions as primary connect
"My daily interactions are based on UCC, it is over Skype, as video meetings, because most resources are spread all over the region. Daily questions, check-ups, debriefings through Skype" (M2). "Everything I do, I do virtual, support is also virtual […] connected with voice […] we are a global enterprise, all the skills I draw on are outside of physical reach" (F10). "What connects me to the organization are the arranged meetings" […] anytime-any device- anywhere […] it gives great freedom, to work like this" (M3). "I'm much more effective with virtual meetings […] we never use video though" (F9).
UCC affords daily interactions in preferred ways. They are carried out from various devices; It can be one-to-one, one-to-many or many-to-many; and be with or without video.

Table 13. Outcome from affordance analysis

Operate a small network of people
"You need to take out a sample of people in the big organization. I'm really close with a few, and then there are a lot of just "Hi" because I don't know who they are […]. I use a lot of time in tending to my network" (F13). "I work in a small team of 5 people - we are a little bubble in a very large organization. We are a team, we are our own employers, I see us as an exo-organization [exponential organization] within a big organization" (M5). "I use Snapchat with my network of colleagues, we send each other pictures of food and inspire each other on the go […] this is very value-adding" (M16). "I have a network that I tend to, that is super important" (M3). "If I reach out to the wisest and smartest, then they pull me in the right direction. I learn from them. Then I grow my market value" (M1).
The goal-oriented actor tends to a network of a few professional colleagues afforded by UCC to reach out and connect.

In the third round of data collection, we wanted to look at the dynamics from a more holistic view of the settings, in which several IT artefacts were represented. From the previous studies, we found it compelling to look at individuals as individuated and as social individuals; and we looked at the setting of structures that would take form from the improvisations made by the members as in Ciborra's (1996) concept of the platform organization.

A core tenet in CR is to understand social reality as an open-layered system of objects with causal powers. It also divides social reality into an actor and structure level. We wanted to explain mechanisms, their properties and interplay between levels of reality that depend on the external as well as internal relationality between the levels and between the mechanisms at work. We conceptualized the *platform-based* organization (PBO) as covering the setting we looked into. The dual-mechanisms and the duality of technology and humans in and between structures were important. We were inspired by Donati's conceptualization of non-mechanical generative mechanism (GM): as causal processes that entail the dynamics of a social structure, with first- and second-order feedback (Donati, 2015). First-order feedback can be positive and negative on individual actions, and second-order feedback can be positive and negative on social relations. An example is the relational process of *individualization and socialization* we arrived at in paper 6 and paper 7. At the empirical level, a GM shows properties such as resilience, elasticity, instability and an interplay between the levels of reality that depend on their external relationality. The (re)forming of structures and routines in PBOs is an example of the interplay of individual actions and social relations. The relational logic is a combinatory logic that is different from linear logic. The logic is based upon interaction and *contradictory complementarity* between two opposite realities and the acceptance of the paradox, without conflating them. The relationship between the two opposites consists simultaneously of a related exclusion and inclusion. As an example, individualization and socialization happen simultaneously. They are not oppositional/conflicting, they enable each other.

According to Donati (2015), GMs enter and influence the system, observable through downward causation. We wanted to see if GMs with contradictory complementarity exerted downward causation in the PBO.

Downward causation is closely related to the concept of supervenience and is used in studies of complex systems that exhibit a kind of self-organization and emergence of visible structures when the systems are far from equilibrium conditions. This was another focus. We wanted to challenge the concept of quasi-stable equilibrium; and the institutionalization and socialization scripts revealed in the literature review performed before this analysis.

Occurrences at the micro-level can directly influence occurrences at macro-level. This influence means that we cannot really understand social relations without knowing something about individual actions. In our study, we separated the empirical level in three sub-levels: first, the individual actions labelled outcomes from the individual-technological relationship (the micro-level); second, the social relations labelled as socio-technical outcomes (macro-level); and third, the societal level, the conditioning context of the PBO.

Any hermeneutic study starts with a pre-understanding of the context in question and a pre-supposition of what is deemed significant. Our pre-supposition was that, in the PBO setting, socio-technical changes unfold differently than explained in prior theories. The hermeneutic circle was central to our approach. The cyclic process of understanding a social phenomenon can only be reached by a dialectic process of narrowing the scope of generic concepts concerning it. In addition, identifying within the 'whole' hierarchy of topics and subordinate topics that constitute the whole (Butler, 1998).

We applied Donati's understanding of an open system to identify the hierarchy of topics. According to Donati (2015), GMs enter a social structure (the PBO setting) that generates a tendency in outcomes (individual-technical and social-technical), these are observable. The structure is relational. The outcomes have a type of regularity (between individual actions and social relations). The type of regularity will depend on the relationality peculiar to its structure. In the PBO, the individual populates the micro-level, whereas the social relations are located at the macro-level. The macro-level outcomes emerge from the micro-level. The relation on the condition context on the micro- and macro-level exerts downward causation (Donati, 2015). In applying a hermeneutic cyclic interpretation, while preserving the separation ontology between the individual, the social, and the technical, we introduced three steps of interpretation to answer the RQ, see table 14.

Table 14. The method of conjecturing mechanisms

Interpretative steps to conjecture dual mechanisms
Step 1: We interpret observable outcomes. a) At the individual-technical (micro) level (we observed several). b) At the socio-technical (macro) level (we observed several). c) Interpret the tendencies (in each outcome).
Step 2: We interpreted the regularities in the system (between the levels a) and b) from step 1).
Step 3: We interpret tedhe mechanisms that cause these outcomes (step 1, and b), tendencies (step 1, c) and regularities (step 2).

Figure 3 is a graphical representation of regularities, tendencies and mechanisms inferred.

The understanding and explanation of dual-mechanisms and their impact is an under-researched area in IS. We suggest to combine the tables 9 and 14 as a future area of research on how to conjecture mechanisms. This would contribute to the IS literature pertaining to analyzing mechanisms such as Bygstad, Munkvold & Volkoff (2016), Volkoff & Strong (2013) and McAvoy & Butler (2017).

4.4 Reliability, validity and triangulation

We are very much aware of the challenges a critical realist has when inferring mechanisms. This is why triangulation is an important element in the entire body of material. According to Golafshani (2003), reliability and validity are conceptualized as trustworthiness, rigor and quality in a qualitative paradigm. It is also through this association that the way to achieve validity and reliability of research gets affected from the qualitative researchers' perspectives, which is to eliminate bias and increase the researcher's truthfulness of a proposition about some social phenomenon using triangulation.

Triangulation is defined to be a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study. Therefore, reliability, validity and triangulation, if they are to be relevant research concepts, particularly from a qualitative point of view, have to be redefined, as we have seen, in order to reflect the multiple ways of establishing truth.

We have sought to lay open the analytical lenses applied to all the data in this section. We have sought a historical and theoretical account for the credibility of the mechanisms. Conjecturing mechanisms that are not observable is difficult and lends itself to the risk of overinterpretation and bias from the researcher. We have drawn on influential thinkers from IS and sociology that have provided us with the mechanisms in table 9. We have used and developed different analytical techniques to study phenomena from different perspectives. We went *outside* of the traditional script of single-case studies, collecting data from individuals across cases, in single interviews reaching in-depth understanding of issues and particularities. We also conducted e-group interviews to look for inter-subjectivity among members in the group. Thus, we believe that we have sought triangulation to reach reliability and validity.

5. CONTRIBUTION AND DISCUSSION

This section presents the contribution to research within IS, and specifically to research which takes into account a socio-technical system perspective in creating socio-technical change and explanations for the interaction between new technology and people in knowledge-intensive global and virtual jobs and workplaces.

We asked the research question of: *how is socio-technical change achieved under the influence of technological individualization in knowledge work settings?*

First, we report on the contributions from each phase and each of the articles. This reveals main gaps and challenges we found, and how the research contributes to filling these gaps. Finally, we present our suggestions to solve the challenges in achieving socio-technical change in the contemporary workplace.

The section ends with a discussion of how we can re-consider the socio-technical perspective under the sway of technological individualization in knowledge work settings in the 21st century.

5.1 Contributions from phase 1 and SQ1

In Paper 1, we investigated and challenged the causal relationship between high productivity in knowledge work as a result of high autonomy in the work performance as described by Drucker (1999). We also examined the autonomy paradox, as expressed by Mazmanian, Orlikowski and Yates (2013), here simply outlaid as a process of more autonomy results in less autonomy when it comes to availability on mobile devices. We found that high autonomy leads to high individual productivity in interaction work. However, this relation was not necessarily translated into an experience of productivity in interaction with others and in the organization. Thus, impacts from increased autonomy, when seen in a socio-technical perspective, were negative (no joint optimization) all the while the individual employee experienced increased productivity, thereby showing positive outcomes.

Apparently, we could not equate high autonomy and high productivity as Drucker (1999) prescribed. We also could not recognize the autonomy paradox as a negative effect of high autonomy. Instead, we saw that employees increasingly took the initiative to adjust and balance autonomy on their own. We saw that if you experienced a lot of autonomy in an area of one's work (optional location), you were inclined to minimize autonomy somewhere else (co-configuring of technology in practice). If you experienced less autonomy in an area (required physical presence in a particular period of time), you maximized autonomy elsewhere (in individual work practices with technology and ways of working). This translated into a complex interaction between productivity, autonomy, technology and the individual knowledge worker in relation to the organization. We now formulate this as a balance, where the individual minimizes and maximizes autonomy according to needs and context. Understandably, the knowledge worker him/her-self is in charge of this balancing.

This expands and adds new knowledge to the autonomy paradox (Mazmanian, Orlikowski & Yates, 2013), which is no longer a paradox or dilemma but seems more as a balance that restores equilibrium by the knowledge worker him/her-self. We also contribute to Drucker's (1999) theorem with the fact that too much autonomy can result in negative productivity, i.e. self-centered behavior can be seen as counterproductive in a working community. The paper contributed with nuances of these concepts. At the same time, it made us wiser about the varied negative and positive effects of using SMC.

In Paper 2, we experimented with a new interpretation framework for categorizing IT knowledge's artefacts (Cabitza & Locoro, 2014) on a spectrum of both objective representativeness and social situativity. The purpose of the interpretative framework was to increase understanding of what kind of knowledge and what kind of output and outcome different applications in knowledge work add to the organization. We categorized UCC as a socially situational application that, through malleability and socio-technical adaptations, could

contribute to quality in sharing practical and action-oriented knowledge vertically at the workplace and thus also would contribute to sociability (Goffee and Jones, 1996).

However, our case showed the opposite impacts with UCC. Therefore, we concluded that UCC, despite of the intention of the design, was in fact so malleable that its purpose could be changed during use, and that the many options for adaptations could result in a waiver of most of them, including video and chat, etc. Thus, the malleability opportunities could *move* the application from one category to another category in the framework. We contributed constructive criticism to Cabitza and Locoro (2014)'s interpretation framework.

At the same time, we found that end-user malleability does not always lead to a socio-technical fit in the form of joint optimization between the technical and social. When end users do not arrive at matching the use to common advantage but only for their own benefit, the opposite is true. With this, we add new knowledge to the theory of end-user malleability as a feature to ensure socio-technical fit as described by Richter & Riemer (2013).

In Paper 3, we explored the possibility to apply persuasive design strategies to increase the use of UCC to precisely create knowledge sharing across the organization and create sociability at work. Based on a categorization of personality traits, special design strategies could push behaviors. Examples were that users, when being conscientious, are susceptible to repetition and commitment. Repetition can be created by praises and reminders from the system, while commitment can be created through social support and facilitation. Thus, we contributed with a design-oriented perspective to the IT knowledge artefact design that could help maintain UCC in its intentional field of application.

The three articles accumulated the knowledge on experience with the use of SMC in the knowledge workplace. We contributed with new aspects and new knowledge. Most importantly, we identified the powerful effect of individual end-user malleability, which resulted in a lack of socio-technical optimization. At the same time, we showed how the individual increasingly took responsibility for productivity by balancing autonomy in a dynamic equilibrium of maximizing and minimizing the physical, practical and temporal conditions and constraints on work. Overall, we contribute with expanding knowledge on theories of autonomy and productivity in the workplace and with a nuanced understanding of negative and positive impacts from SMC on joint optimization in a socio-technical system.

5.2 Contributions from phase 2 and SQ2

In the short-papers 4 and 5, we examined how the socio-technical perspective would clash or complement with concepts like end-user malleability, individual appropriation of technology, networked individualism, complexity issues and simultaneous fits and misfits. The aim was to gain a deeper understanding of the special characteristics and beliefs forming the socio-technical perspective.

Now, we can contribute with a set of tenets in the socio-technical perspective, and we can synthesize on how it clashes with and complements the dynamics in the 21st century workplace. Table 15 describes the core tenets that clash, and table 16 describes other core tenets that complement.

Table 15. Tenets and characteristics in the socio-technical perspective that clash with new phenomena

Core tenets and characteristics in the socio-technical perspective	Clash with new phenomena
Socio-technical approaches focus on design (Mumford, 2006), interventions (Eason, 2008) and of planned changes (Sarker, Chatterjee & Xiao, 2013) in an organization.	The adoption of SMC is autonomous, practical, interactionist and continuously evolving. It is difficult to design and manage. This is a clash.
Socio-technical approaches has a revolutionary approach to change. Socio-technical interventions are	The process of changing work practices with SMC technology emerges as an evolutionary and interactionist process in between the user and the technology. A

planned and managed changes from *old ways of working to new ways of working* (Laihonen et al., 2012)	revolutionary planned change intervention would not yield the same result. This is a clash.
Socio-technical approaches holds a belief of how the reciprocal social-technology relationship embeds shared norms and values around work and behaviors in an organization (Sarker, Chatterjee & Xiao, 2013).	The inherent belief of common ways of working and shared norms around work does not cater to the increased individual autonomy experienced with SMC. This is a clash.
Socio-technical approaches focus on groups sharing a common task (Mumford, 2006)	SMC is adopted individually into work that is primarily non-routine. While many interactions between colleagues and customers do take place, the specific non-routine task is not carried out by a group of people. It is individual. This is a clash.

Table 16. Tenets and characteristics in the socio-technical perspective that complement new phenomena

Core tenets and characteristics in the socio-technical perspective	Complement new phenomena
The objectives are *both* instrumental (productivity) and humanistic (better work enjoyment) (Sarker, Chatterjee & Xiao, 2013)	The individual productive outcomes from appropriation of SMC yield instrumental and humanistic outcomes at the individual-technical level. This is supported as the main objective with socio-technical approaches. This is complementing.
A socio-technical system operates on a dualism. It consists of a social sub-system: employees, knowledge, skills and abilities to carry out work, and the technical sub-system that is hardware, software as well as techniques (Sarker, Chatterjee & Xiao, 2013). The sub-systems are distinct but interdependent. The joint optimization between the social and the technical-sub systems is a core tenet (Eason, 2008; Mumford, 2006). Usually referred to as fits (Cabitza & Locoro, 2014).	The productive outcomes from SMC emerge from a complex dynamic balance between the user, the technology and autonomy in knowledge work. We see maximizing and minimizing autonomy as a way of optimizing, harmonizing and fitting individual practices with the social and the technical. This is one of socio-technic's core tenets. We see them as complementing.
Socio-technical approaches adopt a soft deterministic approach to change in which both freedom of choice and predetermined behaviors are possible. This is a core tenet in the socio-technical perspective (DeSanctis & Poole, 1994)	The SMC technology is so malleable that it can adapt to individual preferences and support specific practices. However, it provides people with a new set of possibilities within a certain area of work, thus changing people's productive practices by the many opportunities presented. This process does hold a soft deterministic position. We see it as complementing.
Socio-technical approaches focus on establishing a harmony, portrayed as an equal balance between social and technical elements (Lee, 2010). However, lately, this focus has been skewed to give prominence to technology and instrumental objectives (Sarker, Chatterjee & Xiao, 2013)	SMC is often brought into workplaces by both individuals and the organization. It is brought in to improve productivity. Use is voluntary (McAfee, 2006) and does not impose any scripts. The result is joint optimization between the individual and the technology. This is complementing.

Tables 15 and 16, derived from papers 4 and 5, contribute to the call for renewal in Bjørn-Andersen & Clemmensen (2017), Sarker, Chatterjee and Xiao (2013), Eason (2008) and Mumford (2006), suggesting which core tenets that are valuable to preserve, and which that will prove ill-suited in the present environment. However, we also contribute with the following three extensions to the socio-technical perspective.

- We expand the focus to holding a more holistic view on the IS. This is to acknowledge the dynamic forces set in motion by SMC and the impact on other areas and levels in the organization. Thus, we supplement the socio-technical system with an individual-technical level. This will make room to acknowledge the process of how individuals balance autonomy, technology and productivity to

produce practical outcomes. It will raise awareness of the continuous and unmanageable improvisation with unpredictable outcomes at this level.

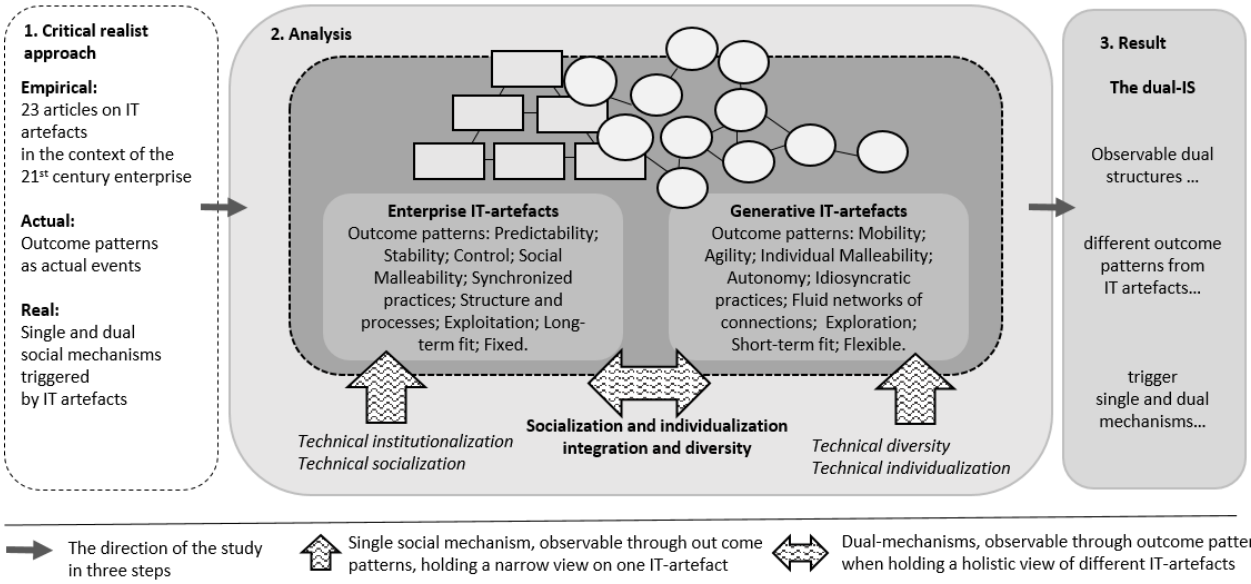
- The separation ontology between what is social and what is technical acknowledges that, to deal with complexity, we need ways to simplify reality. Holding on to separation ontology can provide a distinction between what is individual and what is social and what is technical.

Paper 6 contributes with an explicit discourse on the social and generative mechanisms at work in the IS. "While social mechanisms thrive in IS theory they are rarely explicitly identified and mentioned in the theories" (Avgerou, 2013, p. 407). This denotes a weak discourse on social mechanisms in IS. We found that the discourse in IS did not move beyond explanations of institutionalization. The mechanism of socialization was inherent in the theories but rarely articulated as a mechanism. We found an even weaker discourse on the causal paths of how IT artefacts trigger social mechanisms, and how these mechanisms cause the outcomes from the human-technology relationship. Ropohl (1999) delivered the most specific explanation in terms of technological institutionalization and technological socialization. Inspired by Ropohl (1999), we now label the subset of social mechanisms triggered in the human-technology relationship within an enterprise socio-technical mechanism. We created a subset of such mechanisms from socio-technical philosophy (Ropohl, 1999) and philosophy extending to ICTs (Hofkirchner, 2015; Hofkirchner, 2014).

This subset of mechanisms is a contribution to IS research and to socio-technical explanations. We can now explain how different IT artefacts trigger different social mechanisms of individualization, socialization and institutionalization. Within the context of the socio-technical system, they translate into technological socialization and technological institutionalization as promoted by Ropohl (1999) and now technological individualization. We extend the theory of Ropohl (1999) and contribute to Avgerou (2013) by suggesting a new social mechanism of individualization that accounts for new outcomes in the IS.

We classify the subset of socio-technical mechanisms as an explanatory account of outcomes from the internal relationship between people and technology. This extends the socio-technical perspective with the layer of social mechanisms that can explain outcomes. As such, it is the fourth extension that we suggest.

Figure 8. The dual-IS



In paper 6, we derived two meta categories of IT artefacts from literature. They are distinct and different in their purpose, adaptation and outcomes. Generative IT artefacts set in motion more unpredictable outcomes than enterprise IT artefacts. Generative IT artefacts are much more malleable and mobile. They cater to individual appropriation and autonomy to choose with whom, how and when you interact. The result is network structures. Enterprise IT artefacts, on the other hand, support hierarchical structures. We contribute with figure 8. Figure 8 explains the complex relationship between single social mechanisms and dual-mechanisms, IT artefacts and outcome patterns. We call it the dual-IS. The dual-IS is an original contribution to IS theories dealing with organizational change.

5.3 Contributions from phase 3 and SQ3

In paper 7, we empirically identified the new mechanism of technological individualization at work in the IS. This is a contribution to the discourse on explicating social mechanisms in the IS (Avgerou, 2013). We suspected affordances of autonomy in UCC as an opportunity to individualize practices. We conducted an affordance analysis from the data. From this analysis, we gained empirical evidence on how this mechanism works when triggered. We contribute with rich insight into how the affordances from UCC technology have transformational powers on organizational structures. In figure 9, we illustrate the affordances and outcomes. In figure 10, we illustrate the mechanism of individualization.

Figure 9. Affordances

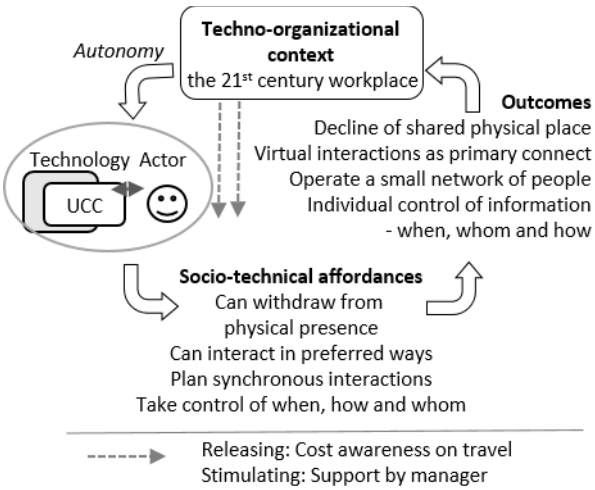


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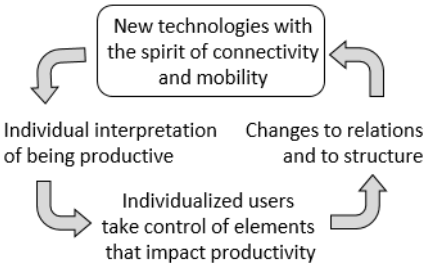
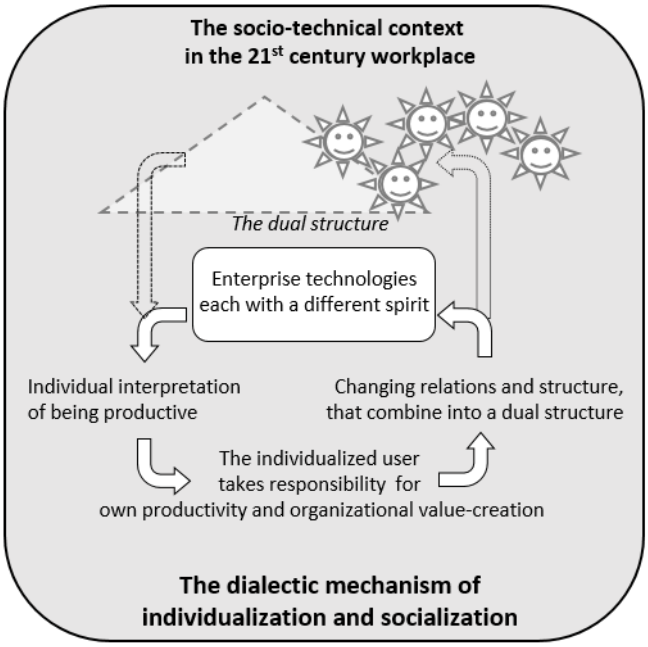
Figure 10. Individualization mechanism



We conclude that individualization is as important to change as institutionalization and socialization. Now, we contribute to the discussion from our previous work on how mechanisms complement each other when activated simultaneously by the subset of technologies present in an organization. The outcomes are dual-structures of hierarchies and small networks as visualized in figure 11.

Figure 11. Impact of individualization on organizational structures



The literature review in paper 7 found an absent focus on the individuated individual, i.e. an individual that caters to own needs and preferences and is free to make choices not under the influence from social norms. However, IS research "typically sees organizations as collections of individuals" (Lee, 2010, p. 342). The theories revealed how individuals (as a collective construct) are under the influence of the system or together constitute the system. There was only sparse literature that took a socio-technical system perspective while dealing with ways in which the individuated individual interacts with the IS. From a few articles, we detected reflections that could mirror individualization, while not directly addressed as such. Predominantly, introduced as future research areas. We now contribute with a socio-technical perspective that takes the individuated individual/individualized user into consideration.

In paper 8, we found that the individuated individual – under the label of the digital individual – transformed the knowledge creation lifecycle as epitomized by Nonaka (1991). We contributed with a hypothesis that the

present dynamics in knowledge work under the influence of SMC technologies render the SECI model ill-suited, and that we need new ways of addressing the powerful influence from individuals taking control of knowledge flows.

In paper 9, we asked how socio-technical change is obtained. First, we found that the view in of socio-technical change literature denotes a linear causal relationship. We found that the main objective of a socio-technical change is quasi-equilibrium from deep structures as described by Wand & Weber (1995). This stability should influence the surface structures made available through the deep structures (Truex, Baskerville & Klein, 1998). As such, it is assumed that socio-technical systems exist in long periods of quasi-equilibrium that can turn into disequilibrium, thus shifting episodically between the states while always settling in a new quasi-stable equilibrium. Much of the research associates change and punctuated equilibrium with deep structures and do not consider surface structures as a component of change and punctuated equilibrium (Lyytinen & Newman, 2008). Much of the research on equilibrium refers to long periods of quasi-stable equilibrium, not considering unstable equilibria as a component of change, in which a system moves further and further away from its original position due to self-enforcing mechanisms (J.R. Hicks, in Metzler, 1945).

We found unstable equilibrium and agility in the surface structures in the socio-technical setting of platform-based organizations, producing unpredictable outcomes from the individual-technological relationship. Now socio-technical changes happen in a paradoxical situation between unstable equilibrium at the surface and quasi-stable equilibrium in the deep structures. This is labeled The Equilibrium Paradox. This change is simultaneous and unpredictable, not linear. We now suggest that socio-technical change must extend to new issues such as generativity and the influences of different structures. See figure 3, in section 3. These new issues both challenge and renew the assumptions about quasi-stable equilibria and punctuated equilibria from Lyytinen & Newman (2008). This extension is important if a socio-technical change theory is to make sense in the 21st century. The Equilibrium Paradox is an original contribution to explaining socio-technical change.

In paper 9, we combined the concept of non-mechanical mechanisms of a contradictory complementary nature from Donati (2015) and the explanations from Hofkirchner (2015) and Hofkirchner (2014) on how institutionalization, socialization and individualization can enable each other. This is a new approach and contribution to explaining how socio-technical change is obtained.

5.4 Contribution from main RQ

We can now say that we contribute to the theories of socio-technical change by introducing the mechanism of technological individualization that explains the impact from the individuated individual who act with less and less influence from the system (Castells, 2014; Benkler, 2006). Increasingly, individual actions relate to fads (Donati, 2015) presented at the surface level, i.e. new devices and SMC applications. Having autonomy to choose, making random changes and improvisation characterize these individual actions.

Technological individualization results in outcomes of smaller networks of self-chosen close colleagues and changes structures and relations in an organization. We now contribute with a view on socio-technical systems that hold dual-structures; that of a hierarchy and that of smaller networks.

Technological individualization has equal impact on socio-technical change as technological institutionalization and technological socialization. They combine into dual-mechanisms when triggered as such. We found combinations of technological individualization with technological socialization and technological socialization with technological institutionalization. These dual-mechanisms have not been studied before in IS or in a socio-technical perspective. Thus, we contribute with an elaboration path to IS theories obtained with social mechanism.

The dual-mechanism is triggered by usage of generative IT artefacts at the surface level of structures: the outcomes are smaller, more autonomous networks operated by the individual with unpredictable outcomes

and simultaneously by usage of enterprise IT artefacts at the deeper level of structures: with predictable outcomes from more traditional organizational forms. The dual-mechanisms extend the theories of socio-technical change from Lyytinen & Newman (2008), Sarker, Chatterjee & Xiao (2013), Eason (2008) and Lee (2010) and follow up on Avgerou's (2013) call for improving IS theories' explainable power by illuminating social mechanisms.

Analyzing the impact from technological individualization and dual-mechanisms demanded an extended view of elements constituting a socio-technical system as previously described by Sarker, Chatterjee and Xiao (2013) and Lee (2010). We now extend it with the individual-technological level that holds features of autonomy and individual productivity. At this level, the individuated individual takes control of information, communication, pace, timing, location and relations. This elaborates on the autonomy paradox by Mazmanian, Orlikowski and Yates (2013). People take control of the information flow and do not submit themselves to other people's requests all the time from everywhere. The reciprocal relationship between subsystems must now cover the level of individual with technology and must extend its explanations of outcomes based on dual-mechanisms that are activated by two meta categories of IT artefacts simultaneously.

The extension covers the simultaneity of changes at different levels that are relational. Understanding individual actions and social relations involves a view in which the individual can be seen as *both* an individuated individual and a social individual. This is a *both/and* view. The result of individuated and social individuals, balancing between two levels of structures, and interacting with two meta categories of IT artefacts that trigger different combinations of socio-technical mechanisms is now what constitutes a dual-IS.

Consequently, we contribute to socio-technical change theory with a view that must illuminate complexity in a dual-IS. The dual-IS holds two levels of human-technology relationships (individual and social), dual-structures (deep and surface) and dual-mechanisms (combinations of technological individualization, socialization and institutionalization). Change happens as evolutions and simultaneously at lower and upper levels. Thus, socio-technical change managers must now focus on how to trigger mechanisms and dual-mechanism in the system.

5.5 Discussion and contribution: reconsidering the socio-technical perspective under the sway of technological individualization

Reconsidering is a cognitive activity denoting to consider something again with an intent to alter it. The main exercise is to be specific about what to discard, what to change and what to keep from figure 1. In phase 1, we used the socio-technical perspective to analyze our data. This produced first-hand experience of the shortcomings in the perspective as a lens, when analyzing the contemporary workplace. In combination with the theoretical exploratory exercises in phase 2, we arrived at two specific sets of core tenets. Table 15 presents the tenets we now discard. While table 16 presents the tenets that we keep. In addition, we expand the perspective with the layer of distinct generative mechanisms. This is a change to the existent theory from Ropohl (1999). Using a set of socio-technical principles will help achieve joint optimization and economic and humanistic outcomes.

Our contribution to reconsidering the socio-technical perspective is by adding a new set of socio-technical principles that will help achieve joint optimization, economic and humanistic outcomes in the 21st century workplace. These principles acknowledge the core tenets that are paramount to the original socio-technical perspective, such as joint optimization; economic and humanistic objectives; an equal balance between two different entities, holding them together; separation ontology; and soft determinism. However, we defy design, planned change, one work system and linearity. The new socio-technical perspective builds on the socio-technical change framework in figure 4.

Below, we derive a set of guiding principles. These principles are followed up by questions that need to be addressed in practice if a new socio-technical perspective should provide value. Figure 12 is figure 4 with a number of useful questions that can ignite a discussion.

5.5.1 Socio-technical principles and practical usage

1. The IS is now a dual-IS. It operates in dual-structures, enabled by different technologies, at two levels, and triggers dual-mechanisms.
   Q: Can we draw our own dual-IS?

2. A socio-technical perspective must no longer plan for causal linearity as in the punctuated equilibrium theory or as the more mechanical reciprocal relationship between sub-systems. In the contemporary workplace, the individuated individual makes random changes to surface structures, i.e. changing work practices with apps and devices, while a social individual simultaneously accommodates work processes in a stable relationship with enterprise platforms.
   Q: How do we include the dual-IS perspective in our implementation activities?

3. A socio-technical perspective must now include the mechanism of technological individualization. Predominantly, SMC triggers technological individualization as a process of individual changes to knowledge work. Work produced at the surface level of structures does not lend itself to standardization, it is inherently non-routine, interactionist, practical and unpredictable. This in turn requires autonomy and flexibility. Enabled with SMC technologies, the goal-oriented individual gains productive behaviors and alters knowledge creation. In many ways, work becomes more fragmented and personalized.
   Q: How do we open up a dialogue that includes technological individualization?

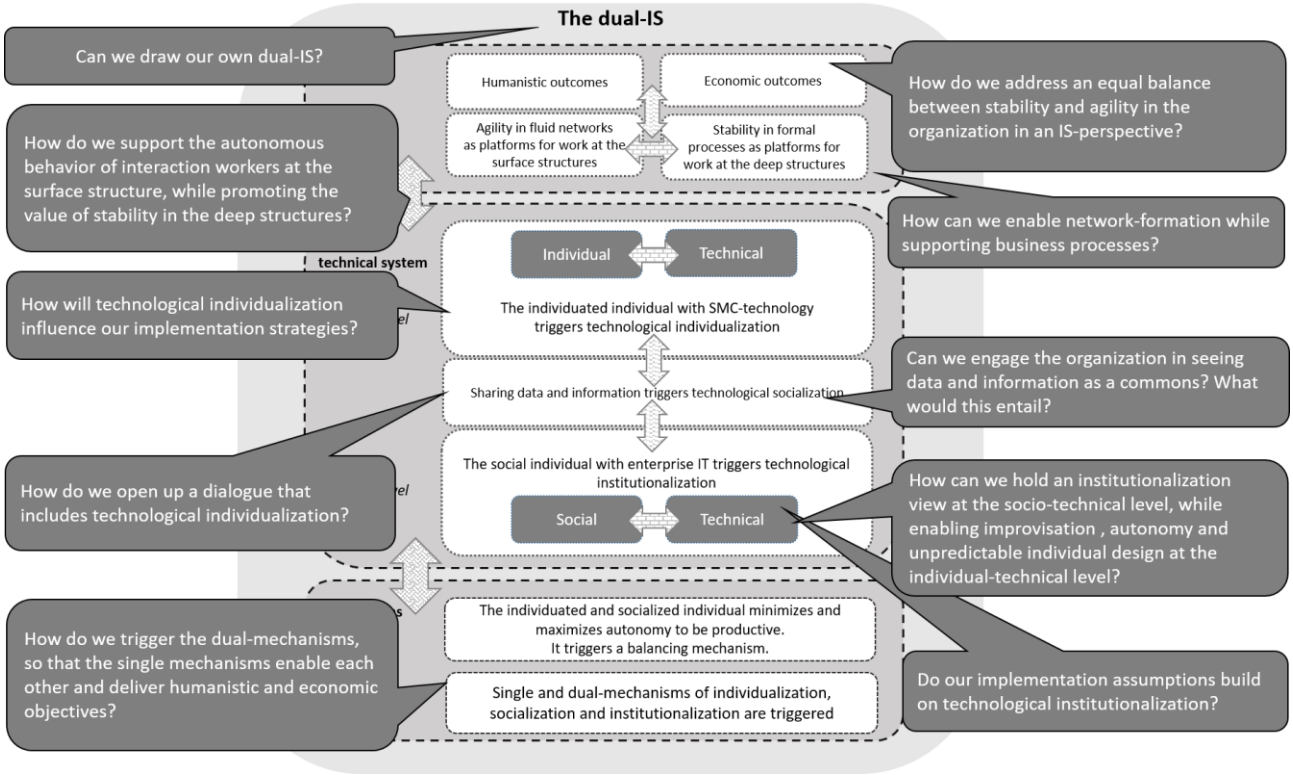
4. We must explain the outcomes and causal paths in the IS by deep understanding of what drives change in terms of basic socio-technical mechanisms. An important addition to the socio-technical perspective is the layer of mechanisms that explain outcomes. How to trigger dual-mechanisms should be part of the discussion on how to plan and obtain socio-technical outcomes.
   Q: How do we trigger the dual-mechanisms, so that single mechanisms enable each other and deliver humanistic and economic objectives?

5. A socio-technical perspective should now cover a socio-technical system that includes a set of dual-mechanisms that can be triggered by IT artefacts of different characters. The different IT artefacts – through activation of dual-mechanisms – have the potential to harmonize a dual-structure organization to exhibit both stability and agility. In a dual-structure system, the individual takes responsibility of producing outcomes of both economic and humanistic objectives by minimizing and maximizing autonomy.
   Q: How can we design and hold an institutionalization view at the deep structures, while enabling improvisation, autonomy and unpredictable individual design at the surface levels?
   Q: How do we support the autonomous behavior of interaction workers at the surface structure while promoting the value of stability in the deep structures?

6. The original socio-technical perspective *implicitly* holds a both/and view, i.e. the equal balance between the social and the technical. The original intention is that the socio-technical system delivers on both economic and humanistic objectives, originally arising from the deep structures through the surface structures. The original socio-technical perspective has a separation view of what is technical and what is social, this is important when simplifying the discussions of how to achieve outcomes. These core tenets

in socio-technic fits well with the new management approaches of ambidexterity (O'Reilly & Tushman, 2013) that likewise promote a both/and view and a balance between stability and agility.
Q: Do we design/and implement for both levels of structures?
Q: How do we address an equal balance between stability and agility in the organization from an IS perspective?
Q: How can we enable network formation while supporting business processes?

Figure 12. Socio-technical change framework as an aide-memoire to practice



7. A socio-technical change perspective must now include the level of data and information. We have illustrated the level of data and information as possibly, triggering socialization in between the individual-technical and the socio-technical levels. We made the logical generalization that data and information, when seen as a shared resource, i.e. a commons, could set in motion a process of socialization denoting shared values and perceptions of important data regimes and autonomy of as an example of tapping into networks of expertise.
   Q: Can we engage the organization in seeing data and information as a commons? What would this entail?

8. A socio-technical approach should now trigger evolutionary responses by triggering the dual-mechanism, thus delivering stability from the deep structures and agility from the surface structures moving the system forward.
   Q: Do our design and implementation assumptions build on technological institutionalization?
   Q: How will technological individualization influence our implementation strategies?

The socio-technical perspective framework explains the new socio-technical reality that, in several ways, extends the understanding of how the socio-technical reality works. We suggest to use the model as an *aide memoire* when discussing and managing socio-technical outcomes. We have inserted the questions in the

model in figure 12. Our aim is to trigger a discussion between IS and business managers as to how to manage and explain socio-technical change.

We also suggest using the socio-technical change framework when explaining past/future outcomes. Several scenarios can be visualized/explained by asking:

a. What type of technology are we introducing/did we introduce (enterprise IT artefact/generative IT artefact)?
b. At what level (individual/social)?
c. What are/were the outcomes (economic/humanistic)?
d. What side of structures do/did we support (deep/surface)?
e. Should/did we pay attention to the other side of structures, objectives, level, IT?

We believe this model can stimulate valuable and important discussions in the debate of IT in an organization. A debate that moves beyond technical features and will illuminate the importance of holding a both/and approach.

5.2 Future research

Several paths of future studies are needed to confirm the findings and the suggested framework:

1) Testing the model's usefulness in case studies. This would entail observations and interventions into the discussions of IS managers.

2) The IS strategic perspective is imperative to changing design and implementation assumptions in organizations. How do we push to an agenda in the organization that builds on a new approach to changes as being evolutionary and that reflects the dual-IS?

3) A very practical question is *how to* trigger the dual-mechanisms that in nature are generative. How do we induce evolutionary responses in the system? This entails case studies in organizations with a need to trigger the dual-mechanism. We suggest investigating this issue further by selecting settings where individualization has turned into egoism. Likewise, we will look for settings where institutionalization has turned into strict regimes.

4) From a more technological perspective, we could apply design science research. This could be valuable in terms of designing interfaces with persuasive design strategies as promoted in paper 3. Another angle would be to trigger mechanisms from a more social-oriented perspective.

5) A reification of knowledge as *a commons* might be a way forward to connect individuals with organizational purpose and the other way around. This could cover issues such as the narrative about "The tragedy of the Commons" from William Forster Lloyd and "Knowledge as a Commons" from Hess and Ostrom (2007). Hofkirchner (2014) explains from a societal perspective how socialization and individualization, when enabling each other, produce the common good. Sarker, Chatterjee and Xiao (2013) make an equal proposal when promoting a view that renewed understanding of socio-technic could be in terms of focusing on the "I" in IS.

6) Several interesting findings have not been highlighted in this cover. They also provide a path for future research.

- The cases where the system breaks down and people "plug off", i.e. quitting structures that are too strict; or where people act more egoistically, choosing other applications than allowed.
- The changing nature of knowledge creation as an increasingly personalized cycle. This could in turn connect to 3.b in as much as establishing knowledge creation as a way to avoid the exploitation of shared resources.

7) Further methodological research into how to study con-com mechanisms is needed. We suggested one way to proceed by combining the methods we applied. This combination needs further development.

6. CONCLUSION

We have had a special interest in uncovering the relationship between the interaction workers' use of SMC technologies that support effective communication, collaboration and knowledge sharing across time and location. These technologies are malleable and adaptable and invite individual appropriation based on their own preferences for what they consider to be productive and value-creating in the context. These workers enjoy a large degree of autonomy to carry out their work. Interaction workers increasingly inhabit the global and virtual working environments. With the increasing use of these technologies in the virtual workplace and their invitation to individual adaptation and appropriation, we looked at individualization. Individualization is an increasing and powerful human behavioral pattern in society, its presence has reduced the importance of social norms and institutional claims. We were interested to see if and how it influenced virtual workplaces. We suspected that it had likewise effects as it has in society.

However, a basic assumption in IS theories about the human-technology relationship is that technology per definition generates successful results by an alignment of uniform behavior (institutionalization) and common norms and values around work execution (socialization) and change. However, with the increasing use of SMC technologies, we anticipated a different dynamic. This motivated our research. If individualization was in fact observable, then we saw a need to alter some of our basic assumptions about how to drive, plan and explain outcomes from technology change projects in the virtual and global workplace. We asked: how is socio-technical change achieved under the sway of technological individualization? With this question, we applied a socio-technical perspective to our research in order to eventually alter it. We suspected that IS managers were struggling with the same defective expectations of IT implementations. Thus, we would be able to provide at tool for managers when investing in new technology at work in order to produce socio-technical change and productive outcomes.

We looked at the individuated individual at work as opposed to the more socialized individual. Based on interpretations of empirical data from individuated knowledge professionals in three critical case studies from different organizations, we acquired knowledge on how SMC technology was experienced in digital and global work settings. We observed that the individualization mechanism was forcefully triggered by malleable SMC technology, resulting in random changes in the outcomes of technology usage in day-to-day interactions controlled by the individuated individual. We found changes in knowledge-sharing behaviors, in how people relate, and how they structure work. Basically, the interaction worker had taken center stage in a complex balancing act between productivity, autonomy and technology, driving individualized change at the workplace.

We have now built an understanding and explanation of how the socio-technical system changes when influenced by individualization. We found that the socio-technical system responds by producing outcomes of dual-structures. Dual-structures in the form of network and hierarchies. We found that a view that holds a layered reality is important in order to understand and explain socio-technical change at the workplace.

The system now constitutes two levels: the individual-technical level and the socio-technical level. At the individual-technical level, IT artefacts with features of end-user malleability and generativity are found. However, at the socio-technical level, a more stable and fixed enterprise system resides.

A core tenet in socio-technical change theory is the concept of punctuated equilibrium. Equilibrium is likewise a core tenet in the socio-technical perspective. Equilibrium in the sense that the social and the technical sides of structures in an organization must adapt to each other in an equal manner. Thus, the system rests in a quasi-stable equilibrium in long periods, enabling the formation of deep structures emerging from the reciprocal relationship between the technical subsystem and the social subsystem. Deep structures set the direction for work and social norms. Changing these deep structures takes a managed and planned punctuation.

However, we found fast and random changes at the surface of structures. These changes emerged from the interactive relationship between individuals and SMC technology. The surface structures' unstable nature accommodated the individuated individual in being even more experimenting, autonomous and productive.

We observed that the organization now rested in a paradoxical equilibrium between instability at the surface of structures and quasi-stability at the deep level of structures. The cause of this change was ascribed the mechanisms of individualization, institutionalization and socialization, activated from the introduction of different types of technologies in the workplace.

We call these mechanisms technological institutionalization, technological socialization and technological individualization. They can combine in different ways and produce unpredictable outcomes. One outcome we observed was that the IS morphed into a dual-IS. The dual-IS operates on sub-sets of socio-technical mechanisms, i.e. different combinations of technological institutionalization, technological individualization and technological socialization. They set in motion different sequences at different levels in the system that responds by forming into different organizational structures that accommodate both stability and agility. Thus, the *both/and* view in the original socio-technical perspective, of holding an equal eye on two, in nature different and separate, entities, while tackling them as one, now becomes ever more important.

We now translate the future challenges in the 21st century workplace inhabited by interaction workers into balancing between technological individualization, technological institutionalization and socialization, to deliver on both economic and humanistic objectives when driving socio-technical change. We believe that our framework of socio-technical change and the suggested practical questions aimed at IS managers can provide a relevant and timely approach to tackle this pressing issue.

7. Glossary

21st century (in relation to enterprise, information system and socio-technical system):
The term the 21st century is used to make a clear distinction and acknowledgement of the changing conditions under which enterprises operate today. Today, conditions are ambiguous, complex and uncertain. This weakens the cause-and-effect relationships present in many theories and explanations from before the turn of the century. The inspiration to use the term comes from Eason (2008). Eason uses the term in the 21st century to distinguish between then and now and uses the turn of the century as a marker for before and after.

Affordances:
Affordances comprise the possibilities for action offered by a technical object and therefore determine the potential use of a technical object (Grgecic, Holter & Rosenkrantz, 2015). The same technical object can support multiple affordances because affordances do not exist without the users' intentions and their context. By adopting an affordance view, we conceptualize a socio-technical mechanism as a relationship between a knowledgeable human and a technological artefact. It is the meeting between a need and a capability, which allows for analysis at various levels (Bygstad, Munkvold and Volkoff, 2016). We regard an affordance as the potential for behaviors associated by achieving an immediate concrete outcome arising from the relations between an IT artefact and a goal-oriented actor (Volkoff & Strong, 2013)

Autonomy:
This term refers to both individuals and groups. Autonomy refers to the capacity of a social actor or a group to become a subject in defining its actions around projects, construed independently of institutions and social norms, with an orientation towards values and interests of the social actor or group. In a workplace setting, autonomy means to have authority over pace, place, time and practical issues of work. It also covers the level of independent judgment and discretion required to do your work (Mazmanian, Orlikowski & Yates, 2013).

Both/and:
The correlative conjunctions *both . . . and . . .* are used to signify parallelism between two conjunctions. The conjunctions are carefully positioned, and their conjoined elements should be well balanced. We use it as proxy for duality and dual, when referring to a way of seeing the dual-IS. The dual-IS entails a both/and view on parallel stability and agility; individualization and socialization; deep and surface structures; individual and the social; fixed and flexible; long-term and short term, etc.

Deep structures:
Deep structures are a characteristic of the information system. They manifest the meaning of the real world that the information system is intended to model. The deep structure properties are robust and stable (Wand & Weber, 1995).

Duality and dual:
Duality is a classification into two subclasses or parts, as in the case of the social and the technical. They are interdependent in nature but different. They are conceptually distinct but interdependent. When presented as a duality, they are no longer separated or opposed. In the socio-technical field, the hyphen is usually applied to signify the dual-nature of the concept. This is the notion of duality. We use the prefix dual to describe duality. We use it in combination with structures, mechanisms and the IS. Thus, we use concepts such as dual-structures, dual-mechanisms and the dual-IS.

Dual-IS:
The dual-IS is a concept derived from this thesis. It was coined during the work that resulted in papers 6 and 7. It basically, means an information system that holds two different but interdependent modus operandi. One modus has features of stability and predictability, while the other modus has features of agility and generativity. These modi manifest as different organizational structures enabled by different types of IT artefacts.

End-user malleability:
End-user malleability as a concept denotes a change in how technologies are adapted to the work processes or work practice. End-user malleability is a feature in SMC technology that gives opportunities and possibilities for the end user

to mold and re-shape the software into serving specific purposes in the context (Richter & Riemer, 2013). End-user malleability establishes conditions for socio-technical fits (Cabitza & Locoro, 2014)

Events:

The term events is used, when we refer to a cluster of observations reported by the respondents. When respondents describe certain events – understood as something that happens – that is unusual or important, we categorize it as an event. Events are observable. We use the term interchangeably with the term phenomena.

Generativity:

Generativity means creative power or property. We use it in combination with mechanisms and with IT artefacts. In combination with an IT artefact, generativity is the capacity of a technology or a system to be malleable by diverse groups of actors in unanticipated ways (Eck, Ubernickel & Brenner, 2015). In combination with mechanisms, it denotes the creative power in a process in a concrete system that makes it what it is (Bunge, 2004).

Individualization:

Individualization is a form of human behavior that surfaced in society as a consequence of globalization and digitalization. Individualization entails the freedom to use one's own resources and to have an individual approach to change while reducing the influence from a system (Baumann, 2011). Individualization entails a process of individuation seen as the construction of autonomy by social actors who become subjects in a process of defining their specific projects in interaction with, but not submission to institutions (Castells, 2014).

Individuation:

Individuation is a cultural trend that emphasizes the project of the individual as the paramount principle orienting his/her behavior. Individuation is not individualism, because the project of the individual may be geared towards collective actions and shared ideals. Work practices in knowledge work have become more individuated than previously and are much more flexible in respect to what work is done now, and what will be done in the future (Castells, 2015).

Individuated individual:

In general, it is individual beings that are formed and differentiated from other human beings; in particular, it is the individual being distinct from the collective. We use the term when we need to differentiate between the individual as a social individual that is under the influence of norms or submission to structures. The individuated individual is oriented towards own values and preferences.

Individual productivity:

Productivity in knowledge work relies on autonomy. Productivity relates to good decisions and judgement in non-routine knowledge work. When the individual takes self-directed choices of how to appropriate practices and technology with the intent to be productive and not under influence of social norms and institutional structures, we label it individual productivity.

Individualized appropriation:

Appropriation can generally be understood as the way in which technologies are adopted, adapted and incorporated into work practices. Appropriation can be defined as the way that users evaluate and adopt, adapt and integrate a technology into their everyday practices (Bødker & Christiansen, 2012). According to Dourish (2003), appropriation relies on flexibility in both practice and technology. When practice-use-of-technology is individualized, we call it individualized appropriation.

Information System Research (IS research):

Information systems research is generally interdisciplinary and concerned with the study of the effects of information systems on the behavior of individuals, groups and organizations (Galliers, Markus and Newell, 2006).

Information Systems (IS):

We use the term information system to denote a system of elements, such as people, technology, structure and information. These elements interact and influence each other. An IS – with all it parts – must deliver positive outcomes to the business and to humans. This is a dominant focus in IS research (Grover & Lyytinen, 2015).

Institutionalization:

We use the term institutionalization when we refer to the process of embedding a certain mode and conception of work and behavior within an organization. Institutionalization is a process intended to regulate societal behavior within organizations or entire societies. It involves rulemaking or installment, adaptation to the rules or to the development of best practices and to changing and replacing these rules. Besson and Rowe (2012) equal institutionalization with stabilization. See *technological institutionalization* for more.

Interaction work/interaction workers:

Interaction work is non-routine cognitive work. It denotes features of discretion, conceptual thinking and personal judgements. It is based on many interactions with other people. It requires a lot of independent thinking and decision-making (Chui et al., 2012). Interaction work is increasingly virtual and thus enabled by technology. In particular *SMC technology*. See *knowledge work settings/knowledge work* for a related description.

IT artefacts:

IT artefacts are applications of IT in the capacity to enable or support some task(s) embedded within a structure(s) that itself is embedded within a context(s). It relies on a causality between context, structure and tasks, as IT becomes artefacts embedded in routines, norms and values (Benbasat & Zmud, 2003). It is an entity/object, or a bundle thereof, intentionally engineered to benefit certain people with certain purposes and goals in certain contexts. It is developed, introduced, adopted, operated, modified, adapted, discarded, and researched within contexts and with various perspectives (Zang, Scialdone & Ku, 2011). We use the concept of the IT artefact to describe two different meta categories of ICT in the workplace. Enterprise IT artefacts, supporting business processes and strict work flows, and generative IT artefacts supporting non-routine communication and collaboration practices.

IT knowledge artefacts:

IT knowledge artefacts denote IT artefacts that are vessels for knowledge that exists in a continuum of objective and representational knowledge in one end of the continuum and subjective and situational in the other end. As an example, enterprise IT systems are objective and representational of the organizational knowledge regime, while SMC technologies are subjective and situational. The primary source used in this thesis of the concept comes from Cabitza and Locoro (2014).

Knowledge work settings/knowledge work:

We use the term knowledge work to differentiate the settings we look at from other work settings. By knowledge work settings, we mean settings in which people use their knowledge and experience to produce the work they are hired to do. Knowledge work is performed in knowledge work settings. Knowledge work can be divided into routine and non-routine cognitive work being performed. The primary task in the knowledge work settings we inquire into is problem-solving that requires a combination of convergent, divergent and creative thinking (Reinhardt et al., 2011). This knowledge work is typically non-repeated, unpredictable and emergent. However, routine tasks are also present. They are typically arranged as repetitive tasks or as automated workflow procedures. See *interaction work/interaction workers* for a related description.

Mechanisms:

Mechanisms, being theoretical tools, have the valuable property of abstraction (Pawson & Tilley, 2004). We use the term mechanisms to explain the particular things that cause a certain event or an outcome. They can explain why a system (i.e. the socio-technical system/the information system) evolves into a certain instantiation. Mechanisms in the sense that they explain "the cause of something"; and what 'enables' or 'leads to' it" (Sayer, 1992, p.104.). We make a clear distinction between mechanical and non-mechanical mechanisms, and we adopt the understanding of non-mechanical mechanism. They can explain why certain events came to be, but they cannot predict them. They give a historic account used to explain why something happens. There is no given explanation of a certain causal relationship between X and Y. We use

them in their generative capacity in which they might produce a certain outcome if trigged in the system. Outcomes will always be unpredictable; thus, the mechanism is generative (Donati, 2015).

Network:
We define a network as a group of individuals who share a common interest or goal. Networks are used for establishing contacts, developing basic relationships and as resources for professional development. Networks tend to be intentionally created, location independent and passive.

Networked individualism:
The concept of networked individualism refers to how SMC technologies transform how people relate. It covers the process of how people have become increasingly networked as individuals rather than embedded in groups. It denotes a social operating system, in which the autonomous individual operates a personal and multifunctional network of relations: it is personal, for multiple users and for multithreaded multitasking. The individual activates the network when needed (Rainie & Wellman, 2012)

Phenomena:
Refers to incidents, i.e. events, deserving of inquiry and investigation, especially events that are particularly unusual or of distinctive importance in the contemporary object of study, i.e. the knowledge work setting in the 21st century.

Socialization:
We use the term socialization, when we refer to the process in which members in an organization adapt to formal procedures and internalize norms and shared values and perceptions. We label socialization a social mechanism. See *mechanisms* and *technological socialization* for further explanation.

Social and generative mechanisms
These concepts are used in this thesis when we specifically draw on mechanisms from social science that are generative in the sense that they hold powers of change, i.e. creative powers, with unpredictable outcomes. A social mechanism, however, is the function it performs in an explanatory account. As such, mechanisms can be described as single mechanisms: socialization, institutionalization and individualization. It is a systematic set of statements that provide a plausible account of how *X* and Y link to one another in a social system (Hedström & Swedberg, 1998). However, the generative nature of mechanisms makes the outcomes unpredictable. When generative social mechanisms combine, they might produce negative or positive feedback, hence halting or enabling each other (Archer, 2015)

Social, mobile and cloud technology (SMC):
These technologies have converged into powerful applications that are easy to use. They are brought into the workplace by both individuals and by the organization. They are end-user malleable and carry predominantly situational and subjective knowledge. They support interactions between peers in virtual and global settings. Social refers to enterprise social media features such as posting, chatting, liking, sharing, etc. Mobile refers to wearable devices that let you connect from anywhere-anytime, while cloud provides a way to access data and technology (Rainie & Wellman, 2012).

Socio-technical change:
In IS research, the punctuated equilibrium model explains a process of change in which the socio-technical system/Information System resides in a state of equilibrium. The state of equilibrium covers a balance between the social- and technical sub-system manifested as the organizations' deep structures. Deep structures denote features of stability and institutionalization. When changes are introduced into the system, the equilibrium is punctuated and enters a state of disequilibrium, i.e. imbalance, until it reaches a new state of equilibrium. The model demonstrates an assumption that the IS rests in long states of stable equilibrium and short states of disequilibrium. This equilibrium is one of the core tenets in socio-technical change theory and the objective of a well-functioning IS (Lyytinen & Newman, 2008).

Socio-technical system:
In IS research, the term socio-technical system is usually given to any instantiation of social and technical elements engaged in goal-directed behavior in an organization. Using the term implies a recognition that organizations have boundaries, and that interactions occur within the system and its sub-systems and between the wider context and dynamics of the environment. As such, it is an open system.

Socio-technical perspective:

The socio-technical perspective highlights the interdependence and complex relationships between people (social sub-systems) and ICTs (technological sub-systems) and emphasizes the co-evolution of these systems, and also that both systems need to be jointly optimized in order to produce positive practical outcomes (Sarker, Chatterjee & Xiao, 2013). The perspective holds certain assumptions around the social and the technical and how they evolve together. First and foremost, no sub-system must take prominence over the other. This in turn establishes a socio-technical system. Second, and following from this outcome, the socio-technical system must, to be effective, exist in a stable equilibrium between the social and the technical (Lyytinen & Newman, 2008).

Soft-determinism:

Soft-determinism is a view that acknowledges that every event, including human action, is causally determined. However, that people act freely when they are not coerced or constrained. As such, people enjoy having authority and control over their actions. Soft-determinism fits well with the critical realist approach in this thesis in which structures are important for the social actor but do not constitute the actor: it gives the actor certain possibilities and limitations, leaving something to the actor him- or herself (Archer, 2015). The socio-technical perspective also represents soft-determinism where adoption of technology is interpreted as a process of organizational change. In this view, the focus lies in the interactive relationship between technology and humans (DeSanctis & Poole, 1994)

Surface structures:

Surface structures refer to a characteristic of the information system; they manifest the nature of the interface between the information system, its users and organizational environment (Wand & Weber, 1995). Surface structures in a technological sense are the interface between the users and the IT systems representing deep structures. Surface structures are increasingly inhabited by SMC technology.

Technological individualization:

The concept emerged in this thesis, denoting an influential mechanism at work in the IS. We use this concept to denote a process in which the individual-technological relationship constitutes individual control of time, pace, location, information streams and relations. Institutional prescriptions and social norms are absent or rejected, and new, individual and innovative practices with SMC technology emerge and evolve constantly. Relations and social structures are re-arranged, and users organize fluently around small personal virtual networks instead of fixed groups and physical locations. Individual practices and behaviors are oriented towards the goal of being productive with new end-user malleable technology.

Technological institutionalization:

Technological institutionalization is the assumption that every technical product incorporates functions which have previously been a personal ability, knowledge and intention and thus inside a certain individual person. This is externalized and objectified in the technical system and thus generalized beyond the individuals. This process of trans-individual generalization of value and behavior patterns is called institutionalization in sociology, and hence, technical development has to be understood as technical institutionalization (Ropohl, 1999). It denotes a process over time: through repeated reinforcement by the community of users, these generalizations or standard ways of working are treated as predetermined and firm prescriptions for social action (Orlikowski, 2000).

Technological socialization:

Technological socialization means the process of when institutions (in the abstract meaning) channel and shape the behavior of the individuals and integrate them into a common culture, an effect which is called socialization in sociology. Formerly, this mainly happened through human communication, but nowadays, technical products exhibit the same performance. When utilized within the socio-technical system, they transfer their institutional power to the individual (Ropohl, 1999). More specifically, it denotes a sequence in a community of users engaged in similar work practices that over time typically enact similar technologies in similar ways (Orlikowski, 2000).

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Appendix 1

Co-configuration in Interaction Work

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Abstract. How to increase knowledge workers productivity is still a puzzle. While knowledge work has become increasingly virtual, collaborative and interactive, we still witness challenges in the area of productivity. We challenge the widespread perception of the causal relationship between high autonomy and high productivity in knowledge work and the fact that configuration and standardization for improving productivity is logical impossible. With a hermeneutical approach we describe and interpret "what is going on" in two different context of interaction knowledge work. Findings suggests that knowledge workers often feel caught in counter-productive practices with technology, due to the autonomous use of Interaction-IT and the challenge of configuring work. We witness different behaviors related to "the autonomy paradox" and we see something interesting happening, when introducing Interaction IT. While configuring work should lower autonomy and negatively influence productivity, we see the opposite. While increased autonomy should increase the productivity, we also see the opposite. We interpret the findings as a balance between autonomy-loss and productivity gain - and as such deliver new insight on the autonomy paradox.

Keywords: Autonomy, autonomy paradox, interaction workers, co-configuring, work-practices, interaction-IT, productivity.

1 Introduction

The increasing demand for complex interaction and collaboration while still having individual responsibility over out-come, is a rising challenge in the workday for workers in knowledge intensive work [1] [2] [3] [4]. Increased specialization in knowledge-work [2] [5], the globalization of work [6], acceleration of time-to-market cycles [5] and the dynamic nature of the workplace are some of the power-full drivers behind the changing workplace [6] [7] [8].

The workers inhibiting the workplace are on wide scale "the interaction workers" [4] a label that differentiates them from other workers, due to the frequent interactions with other people, that are necessary to carry out their jobs. In work – that requires extensive human interactions – we find the doctors, engineers, lawyers, managers, sales representatives, teachers, and other skilled professionals who together serve as the engine of the knowledge economy [4] [5]. Their tasks are everything but routine – it is highly skilled, complex and uncertain work [7] [8] [9]. These workers interact

frequently with other colleagues, costumers, stakeholders and suppliers and make complex decisions based on knowledge, judgment, experience and instincts [4].

The largest growing segment of workers in advanced economies are the interactions workers; 70 % of new jobs created in the US since 1998 have been interaction jobs [1] [4] [10]. They have jobs that require them to spend a lot of their time interacting with one or many people. It involves applying knowledge, judgment, experience and instincts to make complex decisions [4] [10]. Compared to other types of employees, interaction workers play a much greater role in a company's value creation process [4].

Productivity in knowledge work is however a big issue [1] [8]. One of the reasons is that knowledge work does not lend it-selves to re-configuration [4] by routinized processes. Productivity and performance enhancement must emerge in context by the interaction workers themselves.

To accommodate work-patterns, in the contemporary workplace we see a deployment of a new type of technologies. The technologies are in a general term called Unified Communication and Collaboration; in this paper, we call it Interaction-IT. Interaction-IT helps workers connect, communicate and collaborate via different devices and interfaces in a unified way. It includes e-mails, instant messaging, chat, person-to-person or group videoconferencing, presence indicators, mobility solutions etc. Deploying Interaction-IT is optional [11] making it an individual decision how to select, adopt and exploit the different services. The intent with these technologies are increased productivity [12].

Mazmanian, Orlikowski and Yates' investigations [7] of the autonomy paradox among knowledge professionals show that knowledge professionals chose: "*to use their mobile e-mail devices to work anywhere/anytime — actions they framed as evidence of their personal autonomy —the professionals were ending up using it everywhere/all the time, thus diminishing their autonomy in practice* [7, p.1337].

The preliminary interpretations from the two case studies, shows dynamics between choices and the paradoxes of autonomy. We also have an indication that the notion of the autonomy paradox may need further elaboration in order to explain what is going on in our cases.

We formulate the following research question: *What are the implications for increased interactions in the modern workplace supported by Interaction-IT? How does it affect and challenge autonomy and productivity?*

2 Related research and theories

The workplace is increasingly subject to change and transformation. Work is becoming non-routine, specialized, diverse, intense, conceptual, discretionary and complex and based on interactions with others supported by tools and artefacts [2]. New workplace practices - such as flattening of the organization - are bringing more discretion to work [2]. Workers take more decisions build on an increased array of work-related factors. The requirements for effective work performance are thus more complex [2]. In a flat organization, the direct supervision is diminishing this increases the interaction

Appendix 1

between colleagues [4]. Being able to negotiate, collaborate and engage with others is important to understand, communicate and conduct work [2].

Many workers collaborate and communicate from and with people in different locations and time zones [12]. The interactions are increasingly supported and mediated by Interaction IT [3, 13].Work-practices with frequent mediated Q/A's to colleagues, are all a part of the daily activities at work.

Inspired by the concept of "Interaction Work" [4], we define interaction work as different from transactional work and transformational work. Interaction work covers work that requires extensive human interactions; and is unpredictable and non-routine, discretionary, complex, interactive, collaborative and virtual. As stated, the productivity of these workers are central to the overall economy [1] [4] [8]. To increase productivity, organizations develop and deploy "New Ways of Working" initiatives - referring to non-traditional work practices, settings and locations with ICT [14]. Interaction IT is used to ease communication, become faster and more effective at collaboration, performed work from virtually anywhere, anytime [12] [3] [13]. Use of Interaction IT is often supported by top-managers anticipating it can be used to improve flexibility, interoperability, efficiency and productivity [13] [12] [3] [14]

Andrew McAfee [11] defines three different categories of IT: function IT, network IT and enterprise IT. In this paper Interaction IT qualify as a Network IT. Network IT is not imposed or mandated instead use is optional. Logically the pace and uniformity of adoption and exploitation of the technology, can go in many directions and lead to very independent and un-coordinated uses of the technology. According to other research, the risk is minimal because users sharing same context and work-practices, after a while, find synchronous ways of interacting with the technology in practice [15].

Despite the element of increasing interactions, an interaction worker's primary contribution to the overall performance is still a good individual decision [16]. To deliver a good decision, based on individual judgement, autonomy is seen as a key factor in productive knowledge work [8]. Here autonomy is understood as the freedom to exercise judgment and make decisions with minimal interference as well as the authority to define the temporal, physical and practical boundaries of work [7].The causality between autonomy and productivity in knowledge work is supported by many scholars [7] [8] [9].

The degree of autonomy is judged by the extent to which individuals can structure and control when and how they do their jobs [9]) as well as the amount of freedom and discretion an individual experience when carrying out a task [17]. High autonomy is when individuals can determine the order and pacing of job task, specific procedures for accomplishing those tasks, scheduling, coordinating with other employees and other conditions of work [9]. Having established the conditions of knowledge work as becoming increasingly interactive, full autonomy, will in its traditional sense, be quite impossible.

These definitions treat autonomy as a constant, and as such being either high or low. New research suggest that it might be valuable to look at autonomy as a dynamic capability and *"focus on the specific practices and conditions (work, structural, cultural, technological, occupational, market) through which autonomy is more or less likely to be produced in the everyday work of individuals, teams and networks"[7, p. 1353]*.

We are therefore interested in the specific practices and conditions in relation to the use of Interaction IT and the conditions of work. We are interested in how Interaction Workers becomes productive, producing autonomy while interacting with colleagues.

The definition of the autonomy paradox in knowledge work thus becomes relevant to re-visit. The autonomy paradox is when you make a choice to increase your autonomy – as in mobile e-mail devices - but ends up, caught in a situation with diminished autonomy – as in working all the time [7]. We will look at the autonomy paradox trough a focus of the increased level of human interactions in knowledge work supported and enforced by Interaction IT.

3 Methodology and data

Being within the social sciences, we are engaged in the discipline of understanding - not explaining [18]. We work with a hermeneutical approach [19] and can best describe our method as a way of looking into a specific context, describing, interpreting and understanding a hidden world with-in, aimed to see how "life unfold it-self" in two different context of interaction workers.

We interpret the data to understand, through interpretations based on pre-judgments. Through our interpretations, we create and communicate a common understanding reaching fusion of horizon [19, 20]. In table 2 and 4 we present the condensed meanings [21]. In table 3 and 5, we interpret the specific concepts of productivity, autonomy and interaction IT practices. In table 6, we present the findings followed by a discussion, seen through the lenses of the autonomy paradox, presented in table 7. This leads to a discussion of the contributions to research and the theoretical implications we see.

The data stems from two qualitative data sets from two different studies held in the period May 2013 to May 2014 in the Danish departments of two different global organizations occupied by interaction workers, with experienced users of Interaction-IT[1]. We used two slightly different qualitative methods, to gain knowledge from the world of interaction workers. Interested in the shared understandings of work-practices we made group interviews. The first one mediated trough Q/As in a closed group on Facebook. The second as a f2f workshop.

Table 1. Overview of studies

Period	Method	Participants	Organization
First case	Semi-structured interview guide. Questions posed daily in a closed group on Facebook, then transcribed.	10 solutions architects consultants	Global software company.
Second case	Semi-structured interview guide, Focus-group-work with Q/A on post-its, then transcribed.	8 project managers from communication, IT and business	Global engineering company

[1] UC&C from Microsoft covers the programs and platforms known as messenger, Lync, Outlook and Yammer.

Appendix 1

We used the same general questions in both cases. We wanted to uncover the experience of *pains* when carrying out work; what gains they perceived in Interaction IT and in what ways they described their mindset in relation to work. Capturing the meaning we looked for indications of productivity, autonomy and recurrent practices with Interaction IT issues (marked in parenthesis).

3.1 Findings

First case. A group-interview with 10 solution-architects interacting frequently, always on the move. In table 2, we condense the meaning of the quotes, interpreting the experience.

Table 2. Data-set from first case 1

Meaning-condensation	**Mindset of work**
Being a productive knowledge worker is seen as the dominant value. (productivity) The main concern is the ability to process information into knowledge (productivity) The mobility is a defining condition of work, and is seen as a contribution to productivity. (productivity) Being aware of the dependency on the information and knowledge that others willingly share and deliver. (Autonomy and co-configuring)	*"I'm more productive than them (my clients), with my Lync and wireless access. Even the fact that I am standing in my mother in law's kitchen, and can work through my Win8 Phone seems to stress the value of mobile work".* *"a [interaction worker]is a hired person, that can work productively without any specific location"." I do not reflect on negative sides with working that way".* *"Power comes not from knowledge kept, but from knowledge shared."* *"The requirement for the mobile knowledge worker is partially changed from trivia to the ability to access, process and disseminate relevant knowledge in a given situation ."* *"To be able to understand, project, evaluate information and transform into knowledge, not only consume knowledge created by others. And of course being able to do it where-ever and whenever since we are all mobile"*
Meaning-condensation	**Pains**
Using time on ineffective communication and information retrieval is a pain. (productivity, Interaction IT)	*"Time used to find things that are moved around or changed in various internal site is annoying"* *"Mails with redundant information. The same information almost simultaneously from multiple sources"* *"Interruptions (typically via e-mail) with little things you*

Appendix 1

Mails are primarily time consuming and disruptive. (productivity, Interaction IT) The supporting hardware is considered a big element, when being mobile. It has to work in a seamless manner (Interaction IT). Being able to work from anywhere, all the time demands many devices - cables and charges. (Productivity, Interaction IT)	*have to consider and, and after closer inspection do not confer a tangible value or equals the time used"* *"My own irritations are very much in (bad) battery life and the many loose accessories".* *"I have a bag full of small, loose wires and cables etc. sometimes in small loose bags - but it doesn't hold"* *"it never ceases to amaze me that almost every time I walk into a meeting room, anywhere in the world that there are challenges with finding power outlets"* *"And any cable of any sort seems to add complexity."*
Meaning-condensation	**Mindset of work**
A shared understanding of f2f and conference calls as the most effective way of reaching (co-configuring) shared understanding and committing to the decisions (co-configuring, Interaction IT). E-mails are good for instructions (Interaction IT) Chats and calls for clarification (Interaction IT)	*"I prefer e-mail over "speech-and-listen "to give either short messages 1-2 lines not in need of any interpretation IM is also well used for the same purpose".* *"I often see 'people' write long hard/political discursive emails to people who sit a few meters away or even closer, instead of taking mobile/Lync call".* *"It is my experience that you can spend a lot of time on writing an email, just to find out that the receiver is putting weight on something else, so your message is skewed or misunderstood".* *"Sometimes written communication is required – for documentation - and it's still considered trans-boundary to record a Lync Call to document a disagreement!"* *"Therefore: WVIE (Walk, Voice, IM, Email) - that's my priority order"* *"Lync and IM are good for quick clarifications and questions, but f2f is inevitable and the best in ensuring a project meeting with more participants and be attained to the decisions"*

Having gone through the data, we categorized the meanings in relation to autonomy, productivity and practices with Interaction IT. *So what are the main issues?*

Appendix 1

Table 3. Productivity, autonomy and Interaction IT practices in case 1

The productivity agenda is dominant. Wasting time on technology or unproductive behaviors and practices are un-acceptable.	**Produces autonomy** over location, the pace of work and the specific procedures for accomplishing ones task.	A "co-configuring" of the practice use of text, voice and face, establishing productive **practices with technology.**

Productivity is as dominant value in work: *"a [interaction worker] is a hired person that can work productively without any specific location".* A successful mobile knowledge worker demands a lot of the technology and of effective knowledge sharing practices. "Mobility" becomes an identifying feature of work. Mobile in relation to "location", but also mobile in relation to "knowledge".

The ability to connect to relevant and timely information, and turn it into new knowledge, in any given moment, in different settings, is essential. An ability and opportunity to accomplish this task in the most efficient way, is perceived as productivity and determines success. This implies dependency on others. Wasting time on meaningless and redundant work tasks is leading to un-productivity and is perceived as un-acceptable.

Interaction workers herein experience autonomy with freedom of location. Where you work, and where others are, is not important, but the technology to do that, seems to add an element of irritation: "*any cable of any sort seems to add complexity".*

Frequent coordination and communication during the day are a condition of being an interaction worker, with increased interdependence of accessible high-quality information and the people who poses it. A common understanding of what situations determines the use of different services of Interaction IT is evident. The preferences expressed are based on some underlying assumptions about how content fits with the purpose of the interaction: *"Therefore: WVIE (Walk, Voice, IM, Email) - that's my priority order"*.

Second case. We studied interaction workers, working primarily "co-located". We designed a three-hour focus group with 8 knowledge professionals in a Global Engineering Company in May 2014. Data was produced by letting people discus in small groups of 2 and 3, writing on post-its, presenting and then transcribed.

Table 4. Data-set from case 2

Meaning-condensation	**Pains**
The mail- and meeting culture is perceived counter-productive (interaction IT and productivity)	*"Mails are time killers", "# of non-productive e-mails" "time consuming knowledge search, knowledge hogging and waste of time"."What are the rules around mails? => it stresses me…", "The amount of e-mails is a time robber", "Unnecessary cc. in mails",*

Appendix 1

They feel limited to interact from the office (autonomy) Better opportunities for mobility (autonomy) They feel limited by entrenched practices with Interaction IT (autonomy).	*"I'm not mobile enough", "I'm stuck to my desk/screen to interact with my colleagues"* *"I spend a lot of time in meetings (fzf) participating with name not gain".* *"Too much information". "The volume of communication is large, but not necessarily conducted in the right way through the right channels and platforms"*
Meaning-condensation	**Gains and value with Interaction IT**
More productivity, through effective communication practices (productivity) Better collaboration and more time to concentrate (Interaction IT). Less talk and information on some accounts, more talk and collaboration on other accounts (autonomy). They agree that communication with e-mails is unproductive (Interaction IT).	*"Changing the productivity", "Change the way of working and communicating, and become more effective, fun and efficient workplace".* *"Better at collaborating and sharing, through cultural change respecting diversity and cultivate differences breaking down silos"* *"Improving collaboration the matrix way, in the sense of knowledge sharing and transparency"* *"Make communication easier, as in more talk (the human behind), this will improve collaboration, this will give you more time to concentrate".* *"More collaboration, please and less communication, more concentration, less conversations"*
Meaning-condensation	**The mindset of work**
Individual autonomy exercised enacted in pace and order of work (autonomy) Individual practices ranging from being very systemized to the other extreme of doing, everything, always everywhere. (autonomy)	"I work most effectively when I get the time to concentrate", "Time I decide when is appropriate" , "I work best when collaborating, I'm always-on - until I choose to turn it off" "My value as a worker comes from both collaboration, concentration, communication and conversations". "My preferred process is to check mails, talk with colleagues, follow up on the team, then take time to concentrate". "Everything, always and everywhere", "When I want"

Having gone through the data, we analyzed the meanings in relation to autonomy, productivity and practices with Interaction IT. *So what are the main issues?*

Appendix 1

Table 5. Productivity, autonomy and interaction IT practices in case 2

Productivity is important, and current practices seems to inhibit productivity.	Exercising high **autonomy** in individual work-practices, determining the order, the pace and the procedures of they work.	A very limited use of **Interaction IT** manifested in entrenched practices of using e-mail. Not used for mobility and flexibility reasons.

The participants are very concerned with the waste of time they experience from their current practice of communication in e-mails *"The amount of e-mails is a time robber"*. It is obvious that ineffective knowledge sharing is a big issue too and that new practices around collaborating, communication and sharing knowledge would support them in becoming more productive and effective "*Change the way of working and communicating, and become more effective, fun and efficient workplace"*. Being effective and productive is a very important element of work, so is the ability to produce individual practices. Shared assumptions of the importance of having the freedom to choose "when, how and what" is evident *"I'm always-on - until I choose to turn it off"*.

Producing autonomy controlling the pace, order and procedures in carrying out work, seems to have an influence as to how they use Interaction IT. They are sticking to e-mails and meetings - as they seem "a neutral ground" – not challenging the individual autonomy. The *"when I choose"* is thus very dominant.

Interaction IT is not deployed with a mobility purpose, but some would like to adopt it with that purpose *"I'm not mobile enough"*; instead, it is used to confirm already entrenched practices of communication. They seem to feel stock in the office and to their desks.

They express a deep concern of the un-productiveness of their practices of Interaction IT, and the very way they coordinate work and share knowledge at work; at the same time manifesting individual autonomy as a shared value among them, for being productive.

Summary: Now we can communicate what we see is going on in the life of the interaction workers in the two different cases. In table 6 we summarize it.

Table 6. Summary of both cases

Focus	Case 1	Case 2
Autonomy	Produce primarily autonomy on location - but also the pace and order of work.	Produce autonomy when making decisions and deciding on pace, order and procedures of work.
Practices with Interaction IT	Agreeing on purpose and contextual use of the different services in Interaction IT. This alignment is perceived as very effective. Interaction IT is used for mobility, flexibility and	Limited by established practices around e-mailing and meetings, not adopting and exploiting the opportunities of Interaction IT in a common way.

	connectivity.	
Productivity	Productivity is experienced, when they most effectively convert relevant information into practical knowledge, while being mobile. This requires an "all-for-one"-mentality.	Productivity is experienced, when they have the ability to produce a good decision. The contribution to work is individual. An "I'm important" to the overall productivity – mentality.

There are clear differences, but also the same dynamics at play. In the following section, we discuss the very interesting findings and the different patterns of autonomy paradoxes we see in the two cases.

4 Discussion of findings

The analytical lens in is the autonomy paradox: the paradoxical act of choosing a certain behavior, to increase autonomy, while it actually limits autonomy. We condensed the meanings, separated the cases, looking for patterns of autonomy paradoxes. We present our interpretations in table 7, followed by a discussion.

Table 7. The Autonomy paradox - as a pattern.

Case 1	**Case 2**
Autonomy is produced in the conditions of work, being free of location and very mobile.	*Autonomy***:** is produced in the work-practices and there is shared sense of being individually productive.
Productivity: To be productive and deliver value, we see the interaction workers to some extent limit their autonomy. Not in the areas of pace and order in carrying out work. But in sense giving autonomy in the adoption and exploitation of Interaction IT - agreeing on certain practices being better than others.	*Productivity***:** The individual autonomy is produced with such a force, that it seems to inhibit a change of productive work-practices supported by Interaction IT. The individual autonomy exhibited (for being productive) seems to impact the productivity, because not being able to make a mutual ongoing change in communication patterns, keeps them bound in what we could name counter-productive behaviors.
*Mutual adjustment***:** The act – of establishing productive practices with Interaction IT, is a good example of an ongoing co-configuration of work and a perception of being productive.	*Self-centered***:** No mutual adjustment, very individual practices fixed to old practices and a perception of being counter-productive.

What is going on? It is reasonable to conclude that in a world of increased interactions, supported increasingly by IT tools, platforms and devices, working together and sharing knowledge, involves autonomy paradoxes.

Appendix 1

The very notion of sharing knowledge and the needed interactions involves paradoxical behavior, since it implies that you are dependent on "somebody-else". Mutual adjustment and coordination must take place. It seems like it involves both autonomy-losses and productivity gains.

In certain contexts and situations, we see a perceived reasonable balance between autonomy and productivity, securing productive behaviors, in others the imbalance becomes so intense, it has negative impact of perceived productivity.

Re-visiting the definition of the autonomy-paradox is needed. The office workers produce individual autonomy, by holding on to own- and old practices with e-mails and meeting, that has negative implications for productive behaviors not being able/willing to build co-configured uses of the possibilities Interactions IT represents. It seems that holding on to "I'm important" inhibits new productive behaviors. It seems that when having a "All for One" mentality the negative impact of the paradox diminishes.

In the case of the mobile worker, we see a commitment to the co-configured practices. Dependent on effective interactions co-configuring is seen as an on-going recurring activity with a productivity–purpose. This is needed for successfully sharing knowledge, which again is seen as the foundation for being productive. A mutual understanding and on-going adjustment of the use of Interaction IT is a central part in diminishing the negative impacts on productivity, foregoing autonomy. In that sense, the elements of Interaction IT and the power of productivity-gain is changing the choices they take.

In the case of the office worker, we see a different pattern, not covered in the autonomy paradox. The office workers holds on to autonomy, in every possible way. This results in very dissimilar productive practices. The lack of a mutual understanding of the dynamic nature between autonomy-loss and productivity-gains inhibits their ability to adopt and exploit Interaction IT. This leaves them with entrenched practices around e-mails and meetings, making them even less productive. The increase of interactions in knowledge work, are in this case, supported with old ways of communicating and coordinating, producing too many e-mails and ineffective meetings.

The conditions of work, if you are mobile or fixed to a desk, might be the determining factor. Working mobile most of your interactions with colleagues are supported by Interaction IT: making a call from your car, a conference-meeting from home, checking the presence for availability for a messenger chat, summing up in e-mails, looking forward to a F2F meeting with your colleagues, are elements of work. Establishing productive practices around Interaction IT, makes sense; holding on to autonomous behaviors, simply do not.

The causal powers between autonomy and productivity does not hold in the conventional way. With that in mind, the paradox of autonomy losses its meaning, because the autonomy-loss in interaction work is a productivity-gain.

The office workers are fixed to a desk and many interactions are thus taken "over a cup of coffee". A full range adoption of the mobility part of the interaction IT is not needed and does not make-sense. They express a need for changing behaviors with e-mails, but the productivity-gains, might not be obvious.

Appendix 1

Our contribution to the area of the autonomy paradox is that we might improve our understanding of the choices people make in the organization, adopting technology for productive purposes. The underlying paradox of a controversial relation between autonomy-loss and productivity-gain, when it comes to Interaction IT is evident. We believe that this communicate new insights into understanding the very different patterns of the autonomy paradox we are witnessing.

How do people perceive and act around losses and gains. Looking into prospect theory and the endowment effect [22] the fact that once a person practice a behavior, forgoing it feels like a loss. End-users first evaluate the potential change in question as either being a gain or a loss. Changes that are perceived as losses weighs more heavily than changes perceived as gains [22]. This indicate that a mindset of "I'm important" the decision of actually choosing to give up give up some autonomy, relies on the individual, and if not perceiving any gains, he will not even consider the loss. E-mails are often seen as an endowment tool [3]. This would explain difficulties in changing behavior.

4.1 Theoretical implications

Productive knowledge workers needs to have autonomy [8] but in a world of frequent interactions, autonomy, in the sense of being "independent of others", is logically impossible.

The literature defines autonomy as being able to control, decide and determine a large array of different elements of work, ranging from conditions, pace and order of carrying out work. Peter F. Drucker's argument is *"Knowledge workers have to manage themselves. They have to have autonomy"* [8, p. 84]. Support of this argument is implicit in the jobs interactions worker hold, and the fact that they are not easily re-configured. Autonomy is a natural human action [9]. It seems like there is a negotiation; when you acquire/insist/produce/autonomy in one area (technology, behavior, location); it is *ok* to diminish autonomy in another areas. This *negotiation* is new knowledge and could inform the autonomy paradoxes we witness [7]

With the two cases, we witness a difference in how users adopt and exploit the possibilities of Interaction IT, and we relate it to a causal effect of what part of the work, is autonomous. If you are free to choose location, then you can adapt to shared behavior and use of technology. If you are fixed to an office, then autonomy in behavior and technology is important. This *balancing* is new knowledge and informs further the implications as so why so many IT-implementations, don't reap the benefits [11]

It seems that in different settings there is a difference in how they exercise autonomy, but still experience autonomy. As such "*autonomy is as a dynamic capability enacted by workers in practice"*[7, p. 1353] and not a given stable notion.

In interaction work, the traditional/logical relation between autonomy and productivity does not hold. Our findings reveal more complexity in the modern workplace. Our findings show that interactions workers do some configuring themselves. When successfully implemented, they can explain co-configuration as the act of externalizing and visualizing productive behavior with technology together. Co-configuration manifests it-self when shared assumptions are in place of what element

of individual autonomy they perceive as important to context in order to become more productive. These findings support the fact that users in a community with the same work-practices, evidently adopts and exploits the technology in the same way [15]. Under certain conditions, it has positive effects; under others, it has negative effect.

Interaction IT is network IT [11].When interactions are the defining feature of the job, the selection, adoption and exploitation must be mastered better. A uniform adoption and exploitation is central. In our cases, we see why. There is a risk that some elements – such as e-mails – becomes endowment tools, difficult to forgo.

We must re-visit the framework from McAfee [11] with the knowledge of the successful co-configuration we witness. It seems to support the need for establishing a culture of ongoing co-configuration, not just similar engagement of technologies [15]. In a world where time-to-market cycles are speeding up [2], people must engage in social reflexivity [6] to cope with the constant change. Co-configuration becomes the temporal manifestations of productive behavior in interactive work.

5 Conclusion

Our aim with this study was to answer the following research question: *What are the implications of increased interaction in the modern workplace using Interaction-IT? How does it affect and challenge autonomy and productivity?*

As a result, we provide rich insight into the world of interaction workers with two cases. Being dependent on productive practices around interactions needed for carry out work, is an implication. To solve this issue a judgement is made, in relation to if, a new tool supports the over-all result of work: taking good decisions, producing and disseminating high-level knowledge. This is *Co-configuration in Interaction work* - an ongoing practice of exploitation of technologies in an *all for one*-manner. If too individualized the impact on productivity is negative, but the perceived autonomy is high. If *all for one* rules, the co-configuration of productive practices with Interaction IT minimizes autonomy and raises productivity. Whilst the configuration of productive work practices must come from the interaction workers themselves, the process of establishing productive practices in a uniform way, is important too.

More understanding of the underlying human behaviors in the modern workplace, understood as the dynamics between autonomy-loss/productivity-gain and autonomy-gain/productivity-loss, is necessary. We must provide further research of behavioral economics in relation to establishing productive practices with technology in the workplace.

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The misfits in knowledge work
Grasping the essence with the lens of the IT Knowledge Artefact

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Keywords: IT Knowledge Artefact, UC&C, situativity, socio-technical fit, individual practices, knowledge creation.

Abstract: The workplace is changing rapidly and knowledge work is conducted increasingly in settings that are global, digital, flat and networked. The epicenter of value-creation are the individuals and their interactions. Unified Communication and Collaboration Technology (UC&C) supports individual interactions, collaboration and knowledge creation. The use of this technology is growing globally. In a previous study, we found that UC&C in co-located and distributed settings, produced misfits and fits between situated enacted practice-use of UC&C and the experienced productivity. We respond to the KITA 2015 call with this work-in-progress paper. We apply the IT Knowledge Artefact (ITKA)-interpretive lens from Cabitza and Locoro (2014) to a case of knowledge workers struggling with appropriation of UC&C for creating and sharing practice knowledge. We evaluate the framework - and discuss the usefulness of the lens in this specific setting. To further improve and enrich, we pose questions, aiming at contributing to the communication of valuable insights informing the design and use of future KITAs in knowledge work.

1 INTRODUCTION

Interactions between people over distance, time and location has given rise to a new type of Information and Communication Technology called UC&C [1]. UC&C supports interactions, connections, collaboration and communication, providing a unified interface to an ensemble of IT-artefacts like e- mails, chats, virtual meetings, presence and IP-calls (Silic & Back 2013). Applications well known and easy to use. When introduced though, the use is non- mandatory; the adoption is voluntary and the exploitation formed by individual preferences (McAfee 2006). UC&C amplifies the horizontal structure and creation of practice knowledge, that otherwise is difficult to support in virtual work-settings.

Our recent article "Co-configuration in Interaction Work" (Harder Fischer & Pries-Heje, 2015) communicates on several issues with productivity and autonomy in knowledge work, from the individual practice-use of technology. This paper involves a case of socio-technical misfit in an organization and reveals that practice-use of UC&C *in situ* is perceived as negatively influencing community culture and minimizing the opportunities for sharing practice knowledge. Hence, our previous case study reveals a misfit between technology-in-use, knowledge-practices and community culture.

Reading the call for papers for the KITA workshop we were inspired to experiment with the framework of IT-knowledge artefacts (ITKA) From Cabitza & Locoro (2014) and use it as an interpretative lens to gain new insights related to the issues found in our previous work. Working with the framework we experienced some challenges but also some interesting novel insights. In this paper we report on our experience using the framework and invite the KITA community to discuss some of the

[1] Numbers are classified market data, but many and different sources report from 30 – 65 % adoption of UC&C in organizations on a global scale, and increasing

challenges we experienced. Hence, we evaluate the usefulness of the framework contributing to refining and enrich it.

Our overall aim is to minimize the negative consequences of technology in organizations (Harrison et al. 2007) and we believe that a useful interpretative lens can guide analyst and designers when working with ITKA-based applications in organizational contexts.

We believe that an interpretative lens, providing a reification of knowledge, might be a way forward to minimize the misfits in knowledge work. Sarker, Chatterjee and Xiao (2013) makes an equal proposal when promoting a view, that renewed understanding of socio-technical fits, could be in terms of focusing on the "I" in IS, and begin to look at the fit between information and system (Sarker et al. 2013).

Progressing in our on-going studies of value creation in modern knowledge work, we seek to provide new understanding of misfits, tackling them from a socio-technical perspective, seeing them through the ITKA-framework as an interpretative lens.

We strive to answer these questions: *What do we gain from evaluating UC&C as an ITKA in the peculiar setting? Can we use the framework to understand the design and use of this ITKA's in other settings? Can our experiences with the framework reveal new insights that can enrich the interpretative lens?*

2 METHOD

This paper is a reply to the invitation in the call for paper: "we invite other authors to apply this framework to their cases to both validate it and improve and enrich it, as a convenient interpretative lens". Thus, our purpose and contribution with this paper is to evaluate and discuss the framework. Ultimately, to pose questions for a future debate in the KITA community based on our experience. Consequently, this is not a classic paper and this is not a classic method section. This section describes how we have approached this endeavor. First, we must explain our conceptual starting point.

In the out-set, we decided to experiment with how to use the ITKA framework as an interpretative lens - to understand our case in a new perspective. As a starting point, we decided to follow the logic suggested by the paper it-self and produced five consecutive questions that could help us to categorize and classify UC&C. The questions are out-lined in table 1.

Table 1. Questions for categorizing and classifying ITKAs

Question	Five consecutive questions as the interpretative lens
Q 1	Is UC&C an IT-artefact?
Q 2	Is the IT-artefact an IT Knowledge Artefact (ITKA)?
Q 3	Is the ITKA socially situated or representational?
Q 4	Is UC&C an ITKA-based application?
Q 5	Can we classify the ITKA according to the degree of objectivity and situativity, implied from the design input and requirement for the IT artifact as the final out-put.

The questions were intended as a starting point; helping us positioning our work in the framework and start thinking of how to use the framework. This minor experimentation with the framework provided the challenges and insights reported in this paper. We have organized the paper in the following manner.

In section 3, we present our understanding of the case, as it was prior to experimentation with the ITKA-framework.

In section 4, we apply the framework and provide the answers to the five questions defined in order to experiment with the ITKA-framework.

In section 5, we discuss the experience we gain from applying the framework as an interpretative lens; does it make sense and does it provide new insights to the misfit we found in our previous work. We present challenges and insights as questions for future debate.

In section 6, we conclude and answer our overall questions. We conclude suggesting how our experience with the framework may contribute to the evolution and refinement of the interpretative lens and hopefully inspirer to an interesting future conversation in the area of ITKA's.

3 CASE PRESENTATION & UNDERSTANDING

The company has approximately 15.000 employees of whom 1300 works at the head quarter in Denmark. A consequence of the distributed workforce is that people collaborate less collocated and often distributed with project-teams all around the world. They are very dependent on UC&C technology for coordinating work, assisting each other, share knowledge and information in a here-and now manner.

Our presented understanding comes from the interpretation from a facilitated discussion on improving knowledge sharing practices with eight participants from the organization that took place in February 2015. We saw issues of people feeling socially disconnected because of a situated practice of "*never putting on video in virtual meetings and conference calls"…"I now feel a distance to my colleagues".* The interrelatedness in these quotes are better understood from the lens of the social presence theory. Social presence is the acoustic, visual, and physical contact that can be achieved between two [or more] communication partners (Kaplan & Haenlein 2010). Social presence involves intimacy and immediacy in the communication. Following this logic, social presence are lower for mediated (calls) and higher when interpersonal (face-to-face); low for asynchronous (e-mail) and higher for synchronous (live chat) (Kaplan & Haenlein 2010). When feeling caught in e-mails and calls *without face* expressed in *"never putting on video"* the feeling of intimacy and immediacy should be low. It seems that it affects knowledge sharing on a somehow more profound level:*"From previously sharing a lot of day-to-day knowledge to now an obsessive focus on text and documents"…"is changing our knowledge sharing focus".*

The interrelatedness in these quotes are better understood from the lens of Brown and Duguid (2000) promoting how we generate knowledge *in* practice, but implement it *through* process in organizational contexts. *Practice* emphasizes the lateral connections within an organization, the implicit coordination and exploration that, for its part, produces things to do. P*rocess* emphasizes the hierarchical, explicit command-and-control side of organization - the structure that gets things done. *Practice* without *process* tends to become unmanageable; process without practice becomes increasingly static (Brown & Duguid 2000). UC&C, as mentioned in the introduction, is an ensemble of IT-artefacts, supporting interactions between people coordinating and communicating virtually. When emphasizing lateral connections and the implicit coordination between team-members, it becomes clearer that UC&C is a medium for practice knowledge in an organization and as such supports, the horizontal structure in the organization.

The appropriation of UC&C and the situated work practices in this case, is "*changing our knowledge sharing focus" …"From previously sharing a lot of day-to-day knowledge to now an obsessive focus on text and documents".* They communicate work– output and coordinate tasks in a more formal way, using documents and e-mails. It seems that they use UC&C for transfer of information and not for promoting practice knowledge. In communities of practice, ideas move with little explicit attention to *transfer* and practice is coordinated without much formal direction; they seem to acknowledge the lack of practice knowledge as a problem and recognize it as an important element of knowledge creation in an organization.

The lack of social presence and lack of practice knowledge seems to illuminate the cultural change expressed *"previously being socially oriented".* The distribution of colleagues – co-located and distributed - are tipping in the direction of distributed work. In this setting UC&C should/could support the informal connections and social interactions, promoting the horizontal structure in the organization but it seems that it falls short in providing this, due to an emerged situated enacted practice on the individual level, skewing the focus on practice knowledge to a transfer of information. The perceived related change of culture "*changing our knowledge sharing focus and company culture* "seems essential in understanding the situation.

Goffee & Jones (1996) promotes a view on how people relate to a community, based on either sociability or solidarity. Sociability is present when we can see friendliness and non-instrumental relations among members of a community. When we see people share ideas, interests, values and attitudes through face-to-face relations, sociability is build and sustained. Solidarity is when people see each other as instruments for achieving results, pursuing - nevertheless - shared strategy goals quickly and effectively. Building relations with colleagues comes from common tasks, mutual interests and shared goals (Goffee & Jones 1996). Organizations should seek an equilibrium between the two (Goffee & Jones 1996)

When colleagues primarily interacts with colleagues located in other countries and regions, and when the relation is not build or sustained with face-work as in *"never putting on video"* the more instrumental the relationships gets. In this case, it affects all relationships *"I now feel a distance to my colleagues"*. The social side of work decreases and inpersonal relationships arises and the possibilities for creating knowledge trough the sharing of practice knowledge declines.

Our understanding of the case comes from illuminating certain aspects, abstracting it with theory supporting our interpretations. In this case, we see the situated enacted practice use of UC&C influencing the very type of knowledge shared and again

influencing the community culture, which again influences how much importance is put on social presence from the daily appropriation of UC&C. The case reveals a situation of socio-technical misfit. We see the entanglement of people, technology and organizational use (Orlikowski & Iacono 2001) not amounting to joint optimization (Sarker et al. 2013).

3 APPLYING THE ITKA FRAMEWORK

Tackling the situation from a socio-technical perspective, we try to understand why the underlying intention of fit and optimization between the technical system and social system (Sarker et al. 2013) is not achieved. In our former article (Harder Fischer & Pries-Heje 2015), we conclude that users are in fact appropriating this technology, by improvising (Sarker et al. 2013) and adopting individually (McAfee 2006) balancing individual autonomy with experienced productivity in work. On the individual level, they – in socio-technical terms - produce a fit, but on the organizational level these appropriations does not seem to amount to joint optimization.

It seems as if the situated appropriation of UC&C creates a social void inhibiting the general ability to share practice knowledge in the whole organization and in the end – changing the community culture. We seek a deeper understanding of the underlying nature of UC&C grasping the essence of socio-technical fits/misfits in interaction knowledge work.

In this section, we experiment with the interpretive lens of ITKA's from Cabitza and Locoro (2014) applying it in the manner described in section 2, we answer the questions from table 1 consecutively.

Q1: *Is UC&C an IT-artefact?* Orlikowski and Iacono (2001) provides five premises for IT-artefacts. In their view IT-artefacts are not natural, neutral, universal, or given; they are embedded in some time, place, discourse, and community; they are made up of a multiplicity of often fragile and fragmentary components; they are neither fixed nor independent, but emerge from ongoing social and economic practices. They are not static or unchanging, but dynamic. UC&C is clearly dynamic, the appropriation emerges from ongoing social and economic practices and is clearly embedded in a community culture.

UC&C is not neutral or given. UC&C is promoted in organizational settings as enabling easier communication, faster and more efficient collaboration from virtually anywhere, anytime (Silic & Back 2013). Moreover, the intent is to deliver flexibility, interoperability and efficiency (Silic & Back 2013). Hence, UC&C is an IT-artefact.

Q2*: Is it an IT Knowledge Artefact (ITKA)?* We adopt the view from Cabitza & Locoro (2014) defining ITKA as "a material IT artefact which is […] purposely used to enable and support knowledge related processes with in a community" (Cabitza & Locoro 2014). In our case, UC&C is used for transferring information and knowledge. This makes UC&C an ITKA. Underneath the value propositions of UC&C lies an intent of establishing more appropriate knowledge flows in dispersed organizational contexts. The intention of UC&C is clearly to provide a digital manifestation of the horizontal informal structure supporting the flow of practices i.e. practice knowledge in an organization. Either way, seen from the perspective of Knowledge Artefacts (KA) - it could be described as an "item that captures *explicit or [and] tacit* knowledge" (Smith, 2000 in Cabitza & Locoro, 2014). Applying a socio- technical perspective on UC&C, it becomes clear that this IT artifact enable and support knowledge- intensive activities and tasks, hence being an IT- Knowledge Artefact.

Q3: Is it socially situated or representational ITKA? First, we must interpret the nature of knowledge provided as either tacit, cultural, practical and actionable or explicit and representational. Representational ITKA's provides structured sources of static knowledge while socially situated ITKA's acts as a support or scaffold to the expression of knowledgeable behaviors (Cabitza & Locoro 2014) and practices. UC&C has the ability and intentionality to be a scaffold for unfolding practical wisdom (Nonaka & Takuechi 2011) throughout a dispersed organization and as such is the opposite of static knowledge. The ontology is clearly cultural, practical and actionable. Second, we must interpret the epistemology as being either constructivist, interactionist and emergenist or positivist. UC&C is clearly interactionist, providing interactions with an underlying notion of interactions as sense-making. We thus categorize UC&C as a socially situated IT knowledge Artefact.

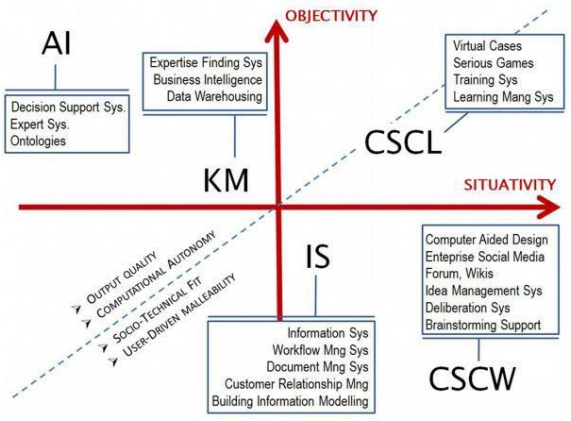
Q4: Is UC&C an ITKA-based application? An IT Knowledge Artifact is a class of software applications that encompass material artifacts either designed or purposely used to enable and support knowledge related processes within a community (Cabitza & Locoro, 2014). UC&C is designed specifically to enable and support the lateral connections and implicit coordination in work, the backbone of

sharing practice knowledge. As such, it is an ITKA based application. Adopting the view from Livari (2007) on typologies and archetypes of IT- applications, we can refine the answer by interpreting UC&C primarily as a medium with the specific role and function to mediate. Livari (2007) mentions e- mails, instant messaging, chat rooms and blogs as examples of mediators. In UC&C, a combination of these applications are unified through an interface with possibilities for talk, calls and video and presence indicators, extending the mediation of text to also sound, picture and presence. The knowledge mode is typically unstructured as in audio/calls and free text. With the use of video, a tacit dimension comes along. In the case, we see that this ensemble of IT-Artefacts also gives way for more structured knowledge modes of transfer of explicit knowledge. The focal point either way is enabling or supporting knowledge related processes and we will categorize it as an ITKA-based application.

Question 5: Can we classify the ITKA according to the degree of objectivity and situativity, implied from the design input and requirement for the IT Artifact as the final out-put.

In figure 1, we see each group of ITKA-based applications associated with a research stream, design principles, values and assumptions of the disciplines that lays at the intersection points in the figure (Cabitza & Locoro, 2014).

Figure 1: Classification of ITKA-based applications. (Cabitza & Locoro 2014)



Having categorized UC&C as a socially situated IT-Knowledge Artefact and as an ITKA-based application, we must be able to express the degree of objectivity and situativity implied by the design input and requirement for the IT-Artifact as the final output. Situativity, is the extent to which the ITKA is capable to adapt itself to the context and situation at hand, as well as the extent it can be appropriated by its users and exploited in a given situation (Cabitza & Locoro, 2014). The situativity side of figure 1 is clearly the appropriate hemisphere. The design principles behind the UC&C is end-user malleability and the values and beliefs of out-put is a socio-technical fit. The objectivity hemisphere implies to what extent the ITKA can handle quantifiably information in a centralized way and to which extent it supports standard processes (objective knowledge) with computational autonomy as design principle and quality as the values and beliefs in out-put. The degree of objectivity in the design of UC&C seems nonexistent. UC&C as a design belongs to the lowest right side in figure 1. The specific appropriation in our case shows an interesting dynamic. Caused by the high degree of situativity, users change the purpose of the design hence moving it towards more objectivity decreasing the perceived socio-technical fit between technology and system.

Seen from the design view it is possible to map UC&C in the right lower corner in figure 1. When appropriated in the specific context of the case, it becomes uncertain to where it *moves.* From the case, we witness a move towards more objectivity interpreted as the need for documenting which implies a preference for quality in out-put. We also witness a deselection of video, implicating *a move away* from practical knowledge created through interactions. What is apparent from our case is that this *move* negatively influences the creation of knowledge through sharing practice and influences community culture. We find that this *move* challenges a meaningful classification.

Table 2: Summary of questions and answers

Questions	Answers
Q1	UC&C is an IT-Artefact; dynamic, embedded in context.
Q2	The intention is to support practice knowledge creation and thus is an ITKA.
Q3	The ITKA is socially situated; an underlying interactionist view on building culture from practices.
Q4	UC&C is an ensemble of ITKA-based applications supporting many practices of knowledge sharing and creation.
Q5	Seen from a design input view a high degree of situativity and user-driven malleability is evident. It should produce socio-technical fits as output. The users appropriate UC&C with intentions of transfer and produces

	misfits. This dynamic makes is difficult to classify meaningful in figure 1.

To make sense of classification, the categorization tool should provide knowledge for designers and analysts to understand better the design and the use from the ontology and epistemology implied. With the possibility of negative impacts from sociotechnical misfits or decrease in quality output, it is essential. It seems that the dynamics in *use* from user appropriation is difficult to grasp in the present framework.

The examples and the research streams of IS, CSCL and CSCW should guide us then. We see some important differences. Reflecting upon the research streams and the associated applications, we sense an underlying notion of planned change (Sarker et al. 2013). UC&C is rarely introduced as a planned change (McAfee, 2006). UC&C is an ensemble ofIT-Knowledge Artefacts, which implies that certain practices with artifacts could come into the foreground, we do not detect the same degree of malleability in IS, CSCL and CSCW. The software applications in the IS-box does not seem to support the important horizontal informal structures supporting the sharing and creation of practice knowledge, created by people and their interpersonal relations through daily situations where social presence is important. We acknowledge that software applications in the CSCW-box supports informal interactions between people, but often in specific project-work with a fixed and planned purpose. In comparison, UC&C is supporting companywide knowledge creation through the ability to share practice knowledge. The software applications in the CSCL-box has specific intentions of organizational learning purposes. In other words, we cannot assign UC&C to any of the research streams.

Experimenting with the framework has been valuable and has given us some new insights and knowledge of the essence of misfits. We find it difficult though to fit UC&C in the contemporary research streams boxing in the software application. We also find it difficult to fixate it in figure 1.

In the following section, we will discuss what we have gained from using the interpretative lens. We end with some questions for the KITA community, to progress in the enrichment and improvement of the framework.

5 DISCUSSION

We have answered the questions out-lined in section 2, with our understanding from the case description in section 3. In section 4 we used the interpretative lens as a categorization tool, just as intended from the authors "A tool for analysts and designers to interpret the peculiarities of the setting hosting ITKAs, as well as to understand the ways and goals according to which ITKAs are built and used" (Cabitza & Locoro, 2014). We will discuss what we gained by answering the questions, interpreting the specific use of UC&C in a case of socio-technical misfit.

In general, by applying the ITKA-interpretative lens, the embeddedness of technology in a complex and dynamic social context becomes clear. ITKAs are neither dependent nor an independent variable but instead enmeshed with the conditions of its use (Orlikowski & Iacono, 2001) and within its culture.

Framing UC&C as an IT-artefact makes sense seeing more clearly the changeable and dynamic nature of the UC&C.

It makes sense to view UC&C as an IT-Knowledge Artefact, since it brings the important element of knowledge creation through sharing of practice knowledge to the foreground.

Categorizing UC&C in the light of ontology and epistemology makes sense, understanding the intentions underlying this ITKA. Defining it as a socially situated ITKA is valuable too, since it brings forward the tension between design-intent and user- appropriation. From our case, we see a clear dependency between the specific appropriation of using UC&C and the transfer of information happening. UC&C in this case, is no mediator of human-to-human interactions increasing social presence. Thus stated as an important foundation for sociability and producing practical knowledge. The use then is different from the design-intention.

Framing UC&C as a specific ITKA-based application – a medium - draws attention to the intention of design and use of the application. Being an ensemble of IT-Knowledge Artefacts, the knowledge forms vary from formal to informal. It highlights the issues and tensions present in the case. The expressed frustration of a socio-technical misfit from an organizational point of view, while at the same time, choosing preferred knowledge modes. These dynamics creates an unintended *move.*

We find it important to understand the nature of implementation with UC&C. Introducing UC&C in organizations is not a planned change. Instead, the adoption is voluntary and random. Andrew McAfee (2009) promotes the view that adoption - as in joint optimization - within this archetype of IT- applications is the sum of a large number of individual choices about which technologies to use

for communication, collaboration and interaction (McAfee, 2009).

In our prior article (Harder Fischer & Pries-Heje, 2015) we saw the paradox of individual knowledge workers producing autonomy in knowledge work settings with UC&C by adopting practices for becoming more productive on the individual level, yet becoming less productive on a collective level.

The ITKA-interpretative lens provides insights and reveals a more fundamental tension between the individual knowledge worker and the organizational setting in which the technologies are appropriated.

Focus on knowledge, the center of knowledge work is a valuable contribution to evaluating UC&C. We have become more aware of the actual meaning that people - appropriating these artefacts - assign to them.

With underlying assumptions about socio- technical fits, it also makes the misfits clearer. Reflecting on situativity and objectivity highlights the relatedness between knowledge, practices with technology and intentions with the software applications, in a specific culture and context.

So why do we have difficulties when classifying the ITKA-based application and draw a box in figure 1? While UC&C certainly belongs to the situativity domain, with aspects of extreme end-user malleability and fit (possibility for misfits) as dominant dynamics, it is still difficult to position it meaningfully. Popular speaking it is a moving target. We are missing a dynamic dimension of *use* truly seeing the impacts from individual or collective appropriations and practice-uses in the situated context. The associated applications within the research streams are designed according to intentions of objectivity and situativity. There seem to be an underlying notion of a logic relationship between design in-put and use out-put. From our case, we report on a change of purpose, from people's practice- use, with the ITKA-based application. These dynamics are the core of situativity. Reflecting on the ITKA-based applications (gathered under research streams), we see a common denominator though; that all of these systems and applications are designed and formally implemented in an organizational context, hence grounded on believe that a fit between intended design purpose and end-user malleability can be
planned and managed.

As such, the framework seems to emerge from established research domains, build from a common mindset of planned change, steered design and mandated IS-implementations. We seem to lack the ability to categorize and classify an end-user malleable ITKA, introduced at random, adopted on the individual level, so moldable and powerful, in a specific time, context and culture that it can change the design intention of the software.

We see some issues that we find important to discuss further in the process of refining the framework in the shared pursuit of providing a valuable tool for designers and analysts to understand design requirements but especially the use of ITKAs in peculiar settings in the future.

We ask the following questions. The questions are our primary contribution in this paper. The questions comes from our experiences from experimenting with the lens from the framework:

Table 3: Questions for the KITA-community

Questions	*How do we tackle:*
1	Dynamic ITKAs from a sociotechnical perspective underlying the interpretative lens?
2	ITKAs influenced by user appropriation, changing the setting of knowledge focus and community culture?
3	The distinction between intentions in design and intentions in use?
4	The difference between planned change and individual driven appropriation of ITKA's?
5	The distinction between ensembles of ITKAs as opposed to single ITKA's?
6	How do we classify and understand moving ITKA-ensembles.
7	The issue of our difficulties of not being able to assign UC&C to a research stream?
8	ITKAs that support both tacit/explicit- and process/practice knowledge?
9	A lens viewing the organizational and the individual level at the same time?

The changes in the workplace, happening right now, seems to be running a little ahead of IS-research. In future knowledge work, individuals and their interactions - and not the hierarchy - becomes the locus of value-creation. Connecting, interacting and producing knowledge of high quality productively/efficiently becomes increasingly important. Knowledge professionals, freelancers and contractors will increasingly configure and co- configure the many ITKAs in order to create value and at the same time be productive. They might even bring with them individualized ITKA software applications and preferences for productive practices. Supporting and sustaining the equilibrium of process & practice and sociability & solidarity will be the foundation for successful and productive value-
creation in networks and communities.

6 CONCLUSION

In this section, we conclude by answering our overall questions: *What do we gain from evaluating UC&C as an ITKA in the peculiar setting? Can we use the framework to understand the design and use of this ITKA in other settings? Can our experiences with the framework reveal new insights that can enrich the interpretative lens?*

The very aim is to take the socio-technical nature of UC&C more serious, to be able to minimize the negative consequences of technology in organizations (Harrison 2007). Seeing UC&C in the light of the ITKA framework was valuable. It gives us a better understanding of the difficulties of joint optimization with the individually driven appropriation of dynamic IT-Knowledge Artefacts in different contexts, with different purposes for supporting knowledge creation.

We support the purpose of the work (Cabitza & Locoro, 2014) seeking an interpretative lens that illuminates the dynamic relatedness between people, knowledge and IT-artefacts and the community culture (evident in this case). It seems that the framework becomes a little backward looking more than forward-looking. We discuss how we meaningfully can classify the individual-driven appropriation of dynamic IT-Knowledge Artefacts in different settings with situated preferences for knowledge sharing and creation. These dynamic forces are important to conceptualize in the framework. We believe that the nature of KITAs with powers to change knowledge sharing focus and community culture is important to understand in the future value-creation process.

We believe that our experimentation with the ITKA interpretative lens and the resulting questions for the KITA-community, will contribute to the work and improvement of the ITKA-framework. We find it important and valuable to support the development of a lens, used by designers and analysts, so that design and appropriation of KITAs in the future workplace can contribute to positive impacts. Grasping the essence of misfits in contemporary knowledge work, would be a valuable starting point.

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Persuasiveness, Personalization & Productive Workplace Practices with IT-Knowledge Artefacts

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Abstract. The workplace is getting increasingly globalized, virtualized and networked. At the same time, work itself has become discrete, autonomous and complex. In a fast changing world, the individual knowledge worker and his interactions becomes the new locus of value creation. Management promote – not dictate - lateral technologies to enable interaction among peers – the core of knowledge creation. To target productive behavior the knowledge professional appropriate these technologies building individualized IT-knowledge artefacts. This practice leads to several dilemmas in enterprise-wide knowledge work. We see a possible way forward for improving workplace practices with IT-knowledge artefact based applications, by combining new insight of how different personality traits prefer different knowledge sharing processes with new insight on personalizing persuasive technology. We explore new research and argument for further research in an attempt to solve the dilemmas in the networked enterprise.

Keywords: Workplace practices**,** IT-knowledge Artefacts, Individualization, Knowledge Creation, Productivity, Autonomy, Persuasive Technologies.

1 Introduction

The main contribution of knowledge professionals is a good decision [1]. Taking good decisions require judgment, instincts, experience and knowledge [2]. Knowledge is created in human-to-human interaction through conversion of tacit to explicit knowledge [3]. Increasingly we see that individuals and their interactions come to the foreground of value creation in the networked enterprise. Discrete decisions and idiosyncratic behaviors in specific situations and varying contexts is thus a natural part of knowledge work [4]. To succeed in competitive markets organizations must therefore support autonomy and allow for autonomous practices [4, 5, 6]. They must also enable high quality interactions among their knowledge professionals.

In the networked enterprise lateral technologies are seen as an enabler of human-to-human interactions [2][5]. Under a unified interface, we find applications such as e-mail, chat, IP-call, virtual meeting, presence, and calendar and message apps accessible from any device connected in the cloud. The applications are easy to use and often well known to people. When introduced the use is non-mandatory; the adoption is voluntary

and the exploitation formed by individual preferences [5] [7]. These technologies bring with them possibilities for interacting more productively, but often we see counter-productive practices and autonomy paradoxes [6]. From a management point of view, productivity enhancement in this non-routine cognitive work is a difficult because it does not respond to the traditional measures of re-configuration and standardization [2]. Productivity and performance enhancement *must emerge* in context by the knowledge workers themselves [2][5][7].

Prior to this paper, we studied two cases of knowledge professionals [5]: mobile workers/solution architects, in a global software company; and office workers/IT-consultants, in a global engineering company, both of which performed many routine and non-routine cognitive tasks (knowledge work) based on many human-to-human interactions during the day mediated by lateral technology. The main finding was a rising tension among professionals tackling the autonomous behavior and individual preferences for IT-knowledge artefacts [8] and the process of interacting with others productively, while delivering value [9].

In this paper, we set out to theoretical explore if the area of personalization in persuasive technology [10] can provide new ways of tackling this tension. We do this by constructing an argument, based on new research, which we will present, for why and how we – the authors – could and should explore this area further.

We have structured the paper in the following way: in section 2, we communicate the productivity dilemmas in workplace practices found in the two prior studies. In section 3, we present new knowledge on the relation between personality traits, knowledge work practices and IT-knowledge artefacts. In section 4, we connect the relevant dots – mainly from theory - of personalization in persuasive technology to the empirical insights of productive behaviors in knowledge work and suggest a road forward.

To make clear our contribution to the personalization in persuasive technology workshop [10] is to participate in developing an approach achieving productive practices of high quality human-to-human interaction with technology in the entangled context of knowledge, people and technology in the networked enterprise.

2 Dilemmas in productive workplace practices

When studying the entangled practice of people, technology and knowledge we apply an interpretative lens from the work of Cabitza and Locoro (2014) [8] to carve a road through the complexity in contemporary knowledge work. The lens focus on the use of IT-artefacts, in the light of how they support knowledge related processes in an organizational context. The lens guides the work of analysts and designers, when designing and understanding IT-knowledge artefacts-based applications in organizational contexts [8]. IT-knowledge artefacts (ITKA) are - paraphrasing Cabitza and Locoro (2014) - a material IT artefact, which purpose is to enable and support knowledge related processes with in a community. ITKA's act as a support or scaffold to the expression of actionable behavior [8]. ITKA's are categorized on a dimension of either supporting representational objective knowledge processes with a stable IT-artefact or socially situated knowledge practices with an end-user malleable IT-artefact.

The purpose of ITKAs are socio-technical fit and joint optimization. Lateral technologies are primarily socially situated ITKA's: they adapt to the context because of user appropriation and exploitation supporting various interactions [9]. In table 1, we report our findings from prior case studies also reported in [5][9].

Table 1. Findings from prior case studies.

The office worker	The mobile worker
We observed that office workers produced autonomy when appropriating the ITKA's. The result was very dissimilar practices. Examples varies from reading e-mails once a day to constantly checking. From putting on video in virtual meetings to holding without. From working at home frequently to feeling obliged to work in an open-office. From preferring e-mails to F2F-meetings. From respecting presence indicators, to requesting attention when people are in "do not disturb me" mode. From trying to codify information instead of keeping it in a process. The individual practice became counter-productive on a collective level. The freedom to appropriate individually was valued, and was experienced to lead to productivity.	We observed that the mobile worker established productive practices by co-configuring the appropriation of ITKA's. They felt very dependent on effective interaction with each other. Being mobile means that you work from anywhere any time. Therefore, they assigned the same purpose to the various applications. E-mail was used when documentation was needed. Calls were good for quick solutions. F2F-meetings were good for collaboration and knowledge creation. Virtual meetings with video were good when not being able to show up physically. The co-configuration created socially situated ITKA's with a socio-technical fit on individual and collective level. The freedom of location was a way to produce autonomy in work.

Table 2. Dilemmas in workplace practices with ITKA's.

Dilemma	Interpretation from case studies
Different use of ITKA's affects productive practices on a collective level.	The use-in practice and the appropriation of ITKA's differ in the case of the office worker - from the mobile worker - in the sense that the socially situated ITKA's are too individualized not producing organizational socio-technical fits.
Mandating change will affect autonomy.	Autonomy in knowledge work is a universal claim; mandated and specified use would affect autonomy. In both cases, the experienced freedom to control practice-use of technology and/or choice of location, are highly valued and is experienced as leading to productivity.
Autonomy lead to productivity.	Acknowledging peoples differences is increasingly important at the contemporary workplace. Organizations allowing people to be one self is according to Goffee & Jones (2015) [11] more successful.

In table 2, we shortly present the abstracted dilemmas from our two cases. What we see is appropriation, caused by a high degree of end-user malleability - and autonomy to do so – resulting in sociotechnical fits at the individual level in both cases, but in the case of the office worker, a misfit on the collective level is experienced [9].

3 Knowledge practices and personality traits

From our empirical studies [5] [9] we find that ITKA's are molded differently and individually both hindering and enabling productive practices at the workplace. We ascribe autonomy as an extrinsic factor that affect the socio-technical fit between people, knowledge and technology. We ascribe the individual preferences and underlying different purposes when users create socially situated IT-knowledge artefacts for individual or organizational socio-technical fit, an intrinsic factor. A not so well described area of intrinsic factors are the personality traits (PT's) and their influence on knowledge sharing behavior. The recent study by Jedar Zelaya (2015), showed an association between PT's and specific knowledge conversion processes [12]. The PT's - the big five factors - are openness to experience, conscientiousness, extraversion, agreeableness and neuroticism [12, 13], referred to as OCEAN. The knowledge creation processes being socialization, externalization, combination and internalization – frequently referred to as the SECI-spiral [3] [12]. While previous research has established a connection between openness to experience and knowledge sharing in general, the present study nuances this view by connecting the different knowledge conversion processes with personality traits. Since no correlation found relating specifically to neuroticism and agreeableness, we have listed the relevant PT's and the hypothetical and theoretical relation we see in table 3.

Table 3. Personality traits connected to SECI and ITKA's.

Personality traits	Connection to SECI	The hypothetical practice with ITKA's
Openness to experience: Curious, imaginative, insightful, original, introspective etc.	Openness to experience is associated with the entire *knowledge conversion spiral*.	Socially situated ITKA's support the whole SECI spiral. Sharing the same PT, practices will lead to individual and organizational fits and is a plausible hypothesis as in the case of the mobile worker.
Extraversion: Active, outgoing, enthusiastic, talkative, rapid personal tempo etc.	Extraversion is associated with *externalization* that is the process of converting tacit-to-explicit knowledge trough conceptualizing.	The ITKA supports the process of tacit-to-explicit knowledge conversion. Behavior of making many calls, replying to e-mails all the time is a plausible hypothesis as in the case of some of the office workers.
Conscientiousness Efficient, organized, planful, reliable. responsible, thorough	Conscientiousness is associated with *combination* that is the process of converting explicit-to-explicit knowledge trough modelling.	The ITKA supports the process of explicit-to-explicit knowledge conversion. Behavior of reading e-mails once a day or pushing for modelling of information is a plausible Hypothesis, as in the case of some of the office workers is a plausible hypothesis.

4 Productive ITKA-practices through personalized persuasive technology

New knowledge on individual differences and susceptibility to persuasive strategies from Akis & Temizel (2015) has inspired us to suggest a way forward in productive knowledge- and workplace practices in combination with personalized persuasive strategies [13]. Changing design elements in the ITKA based applications to target productive knowledge sharing behavior is a possible way forward. We see a logic connection between the findings from the following scholars, also illustrating the logic flow in our thinking:

Fogg's research (1998) on captology [14] inspire us to frame a target behavior of appropriating socially situated ITKA's to support the whole SECI-spiral in the persuasion context of knowledge work mediated by lateral technologies.

From the work of Zelaya (2015) we assume that people with PT of openness to learning already exhibits the target behavior (as seen in the case of the mobile worker) while extrinsic and conscientiousness PT's does not (as seen in the case of the office worker) [12]. We limit our suggestions to these three PT's since Zelaya (2015) did not find a correlation with neuroticism and agreeableness [12].

Alkis and Temizel's (2015) research and new insight on how different personalities are more susceptible to certain persuasion strategies are usefull [13]. They apply Cialdini's six strategies: reciprocation, scarcity, liking, commitment, consensus and authority. The study finds that PT of extraversion are susceptible to reciprocation, scarcity and liking. The PT of conscientiousness is susceptible to reciprocation, authority and commitment. We suggest exploring the possibility to target the PT's with these specific strategies, building them into the design of ITKA-based applications.

We suggest that we continue the work on persuasive system design principles of Oinas-Kukkonen and Harjumaa (2009) and critically select among those design principles that best support the target behavior [15]. We show a preliminary selection and relation between persuasive strategies [13] and design principles [15] in table 4. Since the strategies of liking and authority correlates negatively with other PT's [13], we do not include them at this point.

Table 4. Design principles that support specific persuasive strategies.

Persuasive strategies	Design Principles
Reciprocation	Dialogue support (praise, reminders)
Scarcity	Dialogue support (rewards, suggestions)
Commitment	Social support (ex. social facilitation)

The hypothetical practices suggested in table 3, needs further validation and research. We must further research the direct link between PT's and specific appropriation of ITKA's. The links we argument for in table 4, must be researched and developed further to test if there is a way forward in the area of productive knowledge practices and personalization in persuasive technologies. We must further explore and develop design principles in ITKA-based applications. The aim is new knowledge and framework development on how to establish productive workplace practices with personalized persuasive ITKA-based application supporting enterprise wide knowledge sharing.

In conclusion, knowledge work of high quality is a competitive resource in the networked enterprise. Creating value rely on the quality of human-to-human interaction enabled and molded with socially situated ITKA's with outcomes of socio-technical fit on the individual and collective level. We hope to bring this research suggestion further by engaging in the discussion at the workshop of personalization in persuasive technologies in Salzburg 2016. We will focus on debating the relevance of persuasive technology and strategies in the area of productive workplace practices with ITKA's.

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Appendix 4

Networked Individualism: Toward productive work practices with IT-Knowledge artefacts

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Abstract: In this position paper, we theoretically reflect upon the changes from technology happening right now in the workplace and how it connects with productivity in knowledge work. While enterprises become flatter and work more networked, the individual knowledge worker takes center stage in the locus of value-creation. Supported by social, mobile and cloud technologies, a transformation of knowledge work, as we know it, has begun. To support the individual and collaborative knowledge processes and to fit different contexts, technologies are end-user malleable. End user malleability is an application- feature designed with intent of supporting joint optimization through contextual and situated appropriation in an organizational context. As such, the organization and the individual has an opportunity to continuously and reciprocally create a socio-technical fit – achieving both economic and humanistic objectives. With increased empowerment of individuals and autonomous appropriation of IT-knowledge artefacts, we predict both positive and negative out-comes. We seek to bring forward a theoretical discussion of the complex reality of networked individualism and how it affects the otherwise anticipated organizational deployment of IT-knowledge artefacts for productivity in knowledge work.

Keywords: Networked individualism, knowledge work, productivity, appropriation, end-user malleability, IT-knowledge artefacts, sociotechnical perspective

1 Introduction

In this paper, we open up a discourse around the trend of rising individualism in society and the workplace. In particular we are interested in how it affects the sociotechnical assumption that underlies much of IS research where the human and the technical systems, must each be considered in relation to any IT-enabled change [1]. To reflect upon this matter we use the concept from Rainei & Wellman (2015) of networked individualism [2] to explain the transformation in knowledge work happening right now. We use it to reflect on the trend, that social technologies, mobile devices and cloud services are emerging in the context of the enterprise with the purpose of increasing overall productivity and quality in knowledge

work. We present a new interpretative lens from Cabitza and Locoro (2014) used for understanding the role and purpose of these IT-artefacts supporting and enabling knowledge processes and practices in the organizational context [3]. A focus in the IT-knowledge artefact interpretative framework is end-user malleability, and naturally, the phenomenon of appropriation theory comes to mind [4].

The ontological question we pose, and will try to answer in this theoretical position paper is ultimately if, end-user malleability and the consequential individualized appropriation (due to networked individualism), clash or compliment with the sociotechnical perspective [1].

Bringing forward this position, we hope to contribute to the ongoing debate in IS-research about developing and move forward the sociotechnical theory [1] [5]. According to Sarker, Chatterjee and Xiao (2012) much debate is going on in IS research of how we can all move socio-technic forward. By bringing in networked individualism, we present a dynamic and unpredictable phenomenon in the organizational knowledge ecology, confronting an issue we believe is relevant to IS-practice and theory [5].

How networked individualism will affect the balance in the sociotechnical system is still an open matter but we hope to deliver inspiration and steppingstones moving forward an IS-native theory.

We have structured the paper in the following way. In section two and three, we theoretically account for two aspects of the phenomenon, that we are ascribing transformational powers. 1) Networked individualism as a driver for changing workplace practices. 2) End-user malleable IT-Knowledge Artefacts as a driver for individualized appropriation. As such, we foreground two aspects of the phenomenon, a social aspect in section 2 and a technical aspect in section 3. In section four, we discuss, in theory, the impacts of these two aspects of the phenomena relating to the sociotechnical perspective. In section five we conclude, and raise new questions.

2 Networked Individualism and changing knowledge work practices

Cloud, social and mobile technologies are converging right now, into a “triple revolution” at the workplace [2]. Paraphrasing Rainie & Wellman (2013) the revolution comes from first, the rise of social networking, second, the capacity of the Internet to empower individuals, and last, the always-on connectivity from mobile devices. This has brought on a workplace transformation and a move towards networked individualism [2]. A phenomenon that - in it-self – affects organizational structure [6] [7], job performance criteria [2][7], and the way people interact [3][7]. We characterize the change in organizational structures as the move away from hierarchies to flatter organizations. In a flat organization, coordination is typically conducted through mutual adjustment and frequent here-and-now communication [7]. We explain the change in job-performance criteria, by how knowledge work it-self is changing. We divide Knowledge work into either

routine cognitive work or non-routine cognitive work [7]. According to Billet (2002) the non-routine cognitive work involves more and more discretionary actions, complex decisions and interactions with others, tools and artefacts [5]. Performing in these jobs means applying knowledge, judgment, experience and instincts in order to take complex autonomous decisions in here-and-now situations [6][8]. Researchers from McKinsey labels this type of work interaction work. Compared to other types of work, interaction work plays a much greater role in a company's value creation process [9]. Workers inhabiting these jobs are called interaction workers and they have become increasingly important to the value-creation process in the enterprise. Just as Drucker (1999) – under the label of knowledge workers - foresaw in 1999 and later supported by Davenport (2002) and Castells (2005).

According to Autor & Price (2013), fewer and fewer employment opportunities exist in America for routine cognitive work, while the non-routine cognitive work keeps expanding. Lund et al (2012) report that the largest growing segment of workers in advanced economies are the interaction workers. Interaction workers are different from transaction and transformation workers. While non-routine cognitive work belongs in the category of interaction work, routine-cognitive work belongs to the category of transaction work. 70 % of new jobs created in the US since 1998 have been interaction jobs [7] [8].

Productivity in non-routine cognitive work must come from the workers them-selves [9], [10]. Autonomy to do so, in this type of work, seems to play a key role, not just to productivity but also in job engagement [9]. While autonomy is a natural human need, the phenomenon - and its importance - seem to expand and evolve. From signifying the control of time and pace in work [13] to the control of location and technology. In the future - according to Rainie & Wellman (2013) – it will expand to include the control of network and specific interactions. As Mazmanian et al. (2012) concluded in their research [13] "*autonomy is as a dynamic capability enacted by workers in practice"* [13, p. 1353] and evolving.

As a steppingstone to the next section, we infer – theoretically - that several drivers of change point in a direction of a networked individual being in command of a wider and wider array of elements in the value-creation process at work.

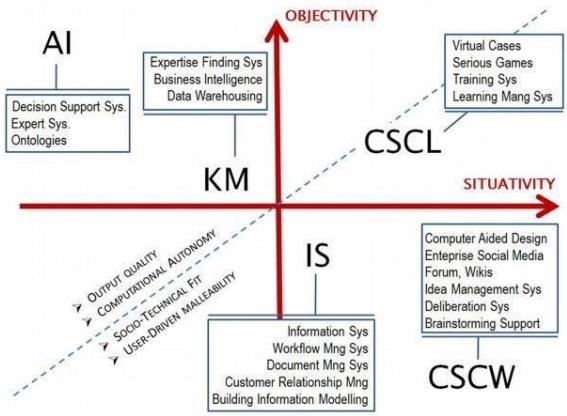
3 IT-knowledge artefacts and individual appropriation

The rise in non-routine cognitive work is also interesting in terms of what it means in relation to what - and how - IT-artefacts are used and adopted in the organizational context. Logically, in a flat, networked, distributed and digital workplace, IT –artefacts specifically supporting more non-routine related tasks and human-to-human interactions will increase. IT-artefact-based applications expanding to the non-routine cognitive work, are social technologies like LinkedIn and Yammer, Message-apps like Messenger and Facetime, Video-calls and -meetings like Skype, Chats like Wechat and collaborative project based

platforms like Slack, file sharing like Dropbox and One drive. All of these IT-artefacts are used by networked individualists.

To study these IT-artefacts, we apply an interpretative lens from the work of Cabitza and Locoro (2014). The lens focus on the use of IT-artefacts, in the light of how they support and enable knowledge related processes and practices in an organizational context. The lens guides the work of analysts and designers, when designing and understanding IT-knowledge artefacts-based applications [3]. IT-knowledge artefacts (ITKA) are - paraphrasing Cabitza and Locoro (2014) - a material IT artefact, which purpose is to enable and support knowledge related processes with in a community. ITKA's act as a support or scaffold to the expression of actionable behavior [3]. ITKA's are either supporting representational objective knowledge processes with a stable IT-artefact (see figure 1 – the upper left hemisphere) or socially situated knowledge practices with an end-user malleable IT-artefact (figure 1 – the lower left hemisphere. The purpose of socially situated ITKAs are sociotechnical fit and joint optimization.

Figure 1. ITKA applications and IS-research domains (Cabitza & Locoro, 2014)



Situativity, is the extent to which the ITKA can adapt to the context and situation at hand, as well as the extent it can be appropriated by its users and exploited in a given situation [3]. The situativity side of figure 1 represents applications with user driven malleability, that - over time - produce a sociotechnical fit. The objectivity hemisphere implies to what extent the ITKA can handle quantifiably information in a centralized way and to which extent it supports a standard process (objectified knowledge) with computational autonomy quality as out-put. Technologies supporting non-routine cognitive work are primarily socially situated ITKA's: they adapt to the context because of user appropriation. New interesting dynamics of appropriation can then rise. Malleable end-user software is characterized by

Richter & Reimer (2013) as flexible and open, towards enabling and supporting a wide variety of work practices without the need for technical customization [14]. Examples are e-mails used in many ways of communicating, planning and collaborating, Facebook can be used for sharing files, be social, or for messaging. Skype provides video to virtual meetings, while also supporting a phone call. Often malleable end user software is not tied to a specific problem-solution such as CRM, ERP etc. Consequently, this results in quite distinct, interaction based use-practices that often are highly confined to a certain context [14] even individual preferences. The high degree of end-user malleability can result in fits at the individual level, but misfits on the collaborative and organizational level. Both human objectives (job satisfaction) and economic objectives (efficiency) can be achieved but only on a personal level. Imagine that anyone knowledge worker can think of himself being productive, but complain about other people's practices.

Appropriation can be defined as the way *"that users evaluate and adopt, adapt and integrate a technology into their everyday practices"* [15]. Appropriation is important because it allows for three important elements: 1) Situatedness: a term that implies that technology is an intervention into a situation. As designers of IT-artefacts, we cannot expect to be able to understand each environment fully and to meet every possible task or need [14]. It is 2) dynamic: since environments and need, change, design for use must be design for change. Finally yet importantly, it shows 3) ownership: paraphrasing Dix (2007) with appropriation comes a sense of ownership and a feeling of control and the feeling that you do things your own way.

End-user driven improvisations and adaptations around technology are not a sign of failure, or things the designer/decision maker forgot. Instead, it shows that the technology has been domesticated and that the users understand and are comfortable enough with the technology to use it in their own ways. Practices with technology are perceived, as the users own [16]. At this point, according to appropriation theory, we know that the technology has become the users' own, not simply what the designer gave to them. According to Dix (2007), this is what appropriation is.

As a steppingstone to the next section, we can state that knowledge workers are first and-foremost autonomous individuals working. As a logic consequence, individual appropriation of ITKA's takes place [17]. Individualized practices and ensembles of socially situated IT-knowledge artefacts eventually bring with them implications of simultaneous fits/misfits in the workplace. This can affect productivity and autonomy - negative and positive.

4 The sociotechnical approach and productivity in knowledge work

The interpretative lens of The IT-Knowledge Artefact [2] draw on the logic from the sociotechnical paradigm [1]. In general, the logic within the sociotechnical paradigm implies that we look at/in an organization/a work system that is made up of a social and a

technical component. We look at *one* technical-system in *one* social system. The sociotechnical approach conceptualizes two mutually interacting subsystems, the technical subsystem (TS) and the social subsystem (SS) [in the boundary of the organization], where the TS stands for hardware, software, databases, as well as techniques, while the SS covers employees, social capital, knowledge bases, skills, and abilities. The sociotechnical approach essentially focus on the fit between the TS and SS and explicitly acknowledges the interdependency between the TS and the SS. Furthermore, a fit/harmony between the two should result in not only increased instrumental objectives (e.g., productivity), but also better humanistic objectives (e.g., better worker enjoyment).The traditional conception of sociotechnic has usually been applied at the specific level of analysis, that of the work system, where work systems consist of work practices, participants, information, and technology [1]. The focus in the design phase is on the reciprocal interactions between the two components, understanding how a fit, or harmony, and/or joint optimization achieved through a planned change. The sociotechnical perspective builds on the assumption that dual objectives (economic and humanistic) are designed and met when implemented. Further, the sociotechnical assumption is that we can plan a positive change by connecting it to a clear purpose (humanistic and economic objective) and intervene in an organization, enabling and supporting productive processes and practices.

As a steppingstone to the conclusion, we infer that interaction workers in knowledge work are highly autonomous and that they will most likely appropriate individualized ensembles of IT-Knowledge artefacts supporting knowledge processes, and develop practices according to their own interpretation of productive behavior. This behavior will produce a fit on the individual level but a misfit on the collective/enterprise level. The sociotechnical assumptions seem to expect mutual adjust and joint optimization.

5 Conclusion

The ontological question we posed is if end-user malleability and the consequential individualized appropriation (because of networked individualism), clash or compliment with the sociotechnical perspective. We opened up a discourse introducing relevant issues by presenting aspects of the phenomena of networked individualism.

Having presented and discussed the different concepts and their causalities, we can conclude that the sociotechnical view seems to have some shortcomings: 1) the sociotechnical seems to focus on the design of a sociotechnical system that benefits all stakeholders, when deployed as a planned change. 2) The intent, and the separation ontology in first design, then use, is difficult to apply, when we observe the situated and dynamic appropriation [13] of socially situated IT-Knowledge Artefacts. 3) Socially situated IT-knowledge artefacts are appropriated by users that makes them their own. We might interpret “a fit” between the individual, their personal preference for knowledge work and

technology. 4) At the organizational level, we will see misfits [17]. The sociotechnical logic seems unable to explain the phenomenon with simultaneous fits and misfits.

If individualism continues to drive changes in the workplace we will witness many different fits between individuals and technology in pursue of productive practices supporting knowledge processes supported by socially situated IT-knowledge artefacts- and applications. The question is how the sociotechnical paradigm can adapt to networked individualism and how it will be able to explain and deliver insights of value when tackling the dynamic nature of individuals, knowledge and technology in future knowledge work.

Inferring from our arguments it seems as if a closer study of both practice theory, but also methodological individualism is much needed to shed light on this matter. On a very posturing note, we conclude that the practices we witness in the workplace resembles more methodological individualism. Methodological Individualism, explains all social phenomena in terms of individual action based on the requirement, that causal accounts of social phenomena, explain how they result from the motivations and actions of individual agents [18]. The core of socio-technic resides within the practice theory, which seeks to explain, according to Dougherty (2010) the relationship(s) that exists between human action, on the one hand, and a global entity, which we call 'the system' on the other hand. Practice theory accounts for a dialectic between social structure and human agency working back and forth in a dynamic relationship [19]. These two views are in opposition.

Our inference might also be wrong. It might be that human agency is indeed what we see (and not methodological individualism), moving back and forth in a dynamic relationship. If this is the case, then we need an adjusted lens in socio-technic addressing joint optimization and fits, from the level of the individual. The influence from networked individualism might be, that locus of value-creation will be the individual interaction worker, and not the firm.

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Appendix 5

Sociotechnical practices and complexity: Studying working in the Cloud

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Abstract: Cloud, mobility and social media are profoundly changing knowledge work practices. Transformation of how to solve problems, take decisions and how to interact change the locus of value-creation. Studying the ongoing interactions among people, technology and organizations, situated historically and contextually, is the core of IS-research. To move forward the development of IS-theory we present a theoretical discussion for why working in the cloud, require us continually to adjust our lens, when studying aspects of complexity and practices. We contribute to the ongoing debate of - and development of - the sociotechnical-lens, suggesting how we open up to practice- and complexity aspects, when working in the cloud.

Keywords: Social Technologies, Sociotechnical, Complexity

1 Introduction

In this paper, we open up a discourse around how to study *working in the cloud*. In particular, we are interested in the sociotechnical lens, often applied when we have to understand and explain "the ongoing interactions among people, technology and organization, situated historically and contextually" [1, p1]. We argue that *working in the cloud* is an emergent sociotechnical complex phenomenon that challenge our lens. Thus, we debate the use, applicability and consequently its future.

Being in a time of paradigmatic change [2], we believe that revisiting core logics within our research-lens is a fruit full activity. We must from time to time ask our-selves if the lens given to us by tradition, still uncovers new insights and important aspects or if it is unintendedly hiding them. While, according to [1]; "All social phenomena may have many potential ways of revealing themselves [..] the way they are realized in practice depends on the mode of engagement adopted by the researcher. ... in choosing a research strategy the scientist in large measure determines how the phenomenon being studied will be revealed, and indirectly, the consequences of the knowledge thus generated" [1, pp 25]. Following up on this line of thought, we ask what does the sociotechnical-lens reveal and, does it generate new knowledge improving our understanding of working in the cloud.

Appendix 5

The purpose of this paper [1] is not to present an exhaustive analysis of the sociotechnical perspective, nor is it to provide any black boxed conclusion on this matter. Our purpose is to provide an inspiring input into the discussion and debate in IS- research of the lens we use to uncover and reveal phenomena and aspects of rigor and relevance. We hope to shed an alternative light on how we can view our lens in time of complexity.

We have structured the paper as follows. In section two, we present our interpretation of *working in the cloud* based on a few selected research contributions [3 - 7] from the field of IS. We frame our interpretation in the light of complexity theory derived from [8]. With this, we offer relevance of the two phenomena, and we yield a reference point for our later discussion on how we study this new reality. In section three, we frame the current situation in IS-research - inspired by [9] - as a *crisis moment* and inquire into the ongoing debate on the sociotechnical based on [10]. First, we describe an ideal form of the sociotechnical; second, we refer to prior forms applied and the consequences of research-choices; third, we follow up on how we move forward adjusting the lens, zooming in on new aspects. In section four, we discuss these adjustments and the applicability to *working in the cloud* (as presented in section 2), and conclude by suggesting how we can further improve a lens studying a complex sociotechnical dynamic system.

2 Working in the cloud – a new complex reality

Complexity theory perspectives involve acknowledging that we live in an increasingly networked, interconnected and globalized world [2]. Complexity theory describes the world as complex to the extent that it consists of always changing, unstable and dynamic systems where there is no consistent relationship between different elements [8]. Interaction between parts may produce unpredictable effects, which however small may lead to massive changes. In complexity theory, there is no simple linearity between causes and effects [8]. In an increasingly networked world, dissimilar and diverse entities and processes are inescapably entangled, in multiplying and ever-changing webs of relationality [8]. We observe that principles of complexity theory are moving in to the enterprise world [2] [5], where a rapidly changing and highly competitive global marketplace increasingly defies command-and-control, and embrace complexity theory as an organizational tool [8].

In the networked enterprise, we see that social, mobile and cloud technologies, providing mobility, connectivity and sociability are gaining a strong foothold [6]. From now of referred to as Social technologies and acknowledged for having a direct influence on organizational revenue, through actively achieving both productivity and humanistic objectives [11]. Social technologies are heralded to help organizations solve pressing problems, by enabling dispersed and fast-changing knowledge sharing, highlighting and leveraging expertise and connect to wisdom of crowds [5] [11]. While social technologies ideally were envisioned to contribute to a digitized and virtual free form of sharing and creation and augmenting organizational knowledge, however as positioned in [5] a much more personalized way of working and augmenting knowledge is observed [3] [4].

Aiming at exactly emergence, Social Technologies offer users malleable design features that make appropriation and domestication easy, while contextualizing and

[1] We are aware that references in this specific paper presents a very subjectively selected set of contributions. The specific collection of literature applied surfaced while conducting another exhaustive literature search for a PhD. thesis and a parallel PhD. course in navigating complexity.

situating the practice-use-of-technology. With these open and end-user malleable platforms, practices in knowledge work is changing. While formerly and formally moving knowledge up and down through the hierarchy (command and control structure) between tacit and explicit knowledge dimensions, Social Technologies now support and enable the creation of situated knowledge, created among individuals, continuously in flow [7]. This social and informal character of knowledge creation, represent a process that is *diverse* [12]. Thus, these technologies increasingly enables emergent structures and knowledge creation [7]. The very conduct of work, knowledge sharing and information exchange is channeled through multiple informal knowledge streams between individuals and communities, gradually separated from organizational knowledge [3].

An important feature of the social network is the widespread access to expertise within and beyond the firm boundaries [3]. In this new connected environment decision-making and problem-solving is changing. Knowledge workers increasingly use their social network to rapidly identify and access content or people that will be use full for solving their tasks [3] [4]. The social network consequently becomes personal, and the individual is the autonomous center interacting with diverse others: doing several things simultaneously [6]. The new locus of value creation manifests as the individual interacting with diverse others enabled by social technologies.

The enterprise infrastructure, once a stable environment, now involves open platforms, cloud services and mobile devices [3]. In these new dynamic arrangements, the *cloud worker* moves metaphorically in-and-out, up-and-down, while fine-tuning the arrangements with external single-function apps. Digital supports selected, adopted and exploited by users are seamlessly woven into the digital environment, directed at emergent productive practices and high quality outputs.

We end this section, by inferring that knowledge work is changing dramatically. That work if predominantly are conducted in digital environments, contains 1) multiple simultaneous situated and contextual knowledge flows, 2) personalized social networks, 3) enablement by a varied set of social technologies (apps, platform and devices) 4) continuously selected and molded to the users 5) ultimately changing decision and problem-solving practices 6) thus becoming the locus of value creation. *Working in the cloud* consists of simple parts that irreducibly interlinks into complex sociotechnical arrangements.

The above description covers the interlinking between technology, people, organization and knowledge. While the complex world, cannot be described in positivist terms or as a simple reality consisting of fixed and separate entities; or by linear relations of cause and effects [8] we ask what lenses or adjustment of lenses do we need to describe complexity. We want to carve a road through it, simplifying it with-out reducing it to a simple reality [8].

3 On-boarding the Socio-technical debate

In this section, we present one stream of debate of the sociotechnical. We do this in order to inquire into what the lens reveals and to what extent it is applicable for studying *working in the cloud*.

Inspired problematization [9], and for the sake of exploration, we preciously label the present moment *a crisis moment* in IS research. A crisis moment situation provides us with an opportunity to inquire into the emergence of what comes to appear self-evident by being firmly in position, while being questioned [9]. The main exercise is to seize the moment, when givens become questions, or problems.

The main lens in IS-theory – the sociotechnical perspective - is in simple terms used to view the organization as a sociotechnical system. Many forms and ways in which to

study organizations based on a sociotechnical logic exists; typically differentiated by their imagined place on a continuum of either social- or technological determinism. In the middle (off-course) lies an equilibrium point in which traditional socio-technic lies.

The sociotechnical approach is a lens viewing two mutually interacting subsystems, the technical subsystem and the social subsystem. The sociotechnical approach essentially focus on designing a *fit* between the two and explicitly acknowledges the interdependency. Furthermore, the purpose of fit and harmony is both instrumental objectives, but also better humanistic objectives. Traditionally the lens is applied to a work-system. A work-system consists of practices, people, information, and technology, as well as its outputs (products/services) and the external environment. Thus, work-systems are understood as sociotechnical systems by default. The sociotechnical lens, reveals aspects of 1) balance/imbalance between the social and the technical component (with an even-handed emphasis). 2) The reciprocal interactions between the two subsystems. 3) fit, harmony, and/or joint optimization between them 4) and dual objectives (instrumental and humanistic) [10].

While this is the ideal and logic in socio-technic thinking, the sociotechnical lens has translated into several forms during a long life of existence, ranging on a continuum from technical determinism to social determinism and analytical dualism to duality between the social and the technical [10]. Accordingly, the examination of different ways and forms of how to *think socio-technically* has led us to seize the moment and reflect on shortcomings. Many of which can be related to a particular research strategy chosen, determining how the phenomenon being studied have been revealed [1] [10], and indirectly, the consequences of the knowledge thus generated. In summary we mention that certain research scripts has led to 1) a disconnect between the social and the technical. A disconnect stemming from an "ontology of separateness" aligned with the use of a realist and reductionist approach. A certain and popular way of researching IS implementation as a managed change by the implementer/designer from outside the system, characterized by a subject/object dualism [10]. 2) Joint optimization translates into rearranging the social system around an existing technology in order to approximate joint optimization. 3) The element of mutual interactions is inherently lacking, since much of the progress in the IS discipline has followed a modernist paradigm which has a positivistic worldview characterized by mechanistically reducing and decomposing complex problems into simpler ones.

To mend these misconceptions, [10] suggest three ways forward. 1) By questioning, the understanding of the separation between the social and the technical, a move to duality is suggested, thereby acknowledging the entanglement of the technical and the social. 2) The underlying positivist view of being able to single out cause and effect does not apply in a complex world and other views must be applied. 3) conclusively, we must study phenomenon of interactions between people, knowledge and activities.

The above presentation of the sociotechnical perspective reveals that the application of the lens is largely affected by the view of the researcher [1], as described in the introduction.

4 Discussion and conclusion

Inspired by the call for renewed focus on interactions in the former section, it seems as if interactions *has been forgotten* [8] or *hidden* [9] behind the simplistic view or focus of the structures and the inherent technical deterministic view. Moving these interactions to the foreground represents more unpredictability in our studies, since "interactions between parts may produce unpredictable effects which, however small, may lead to massive changes in the future" [8]. This might well be a root-cause since a reductionist and positivistic ontology will not reveal such effects.

Appendix 5

Unpredictability is a core condition in a complex world. To accommodate the complex reality we suggests to replace the idea of planned change and look at how people improvise, enact and practice knowledge work. With a return to dualism, we might also reveal the constitutive entanglement of the social and the technical.

The phenomenon - *working in the cloud* – (in the light of complexity) has an underlying ontology that is clearly practical and actionable. Second, the epistemology is constructivist, interactionist and emergenist.

Studying working in the cloud with a renewed focus on fits, dualism and improvisation, would foreground some interesting aspects of the socio-technical fits now being enacted on the individual level, and how it relates to perhaps a new formulation of what joint optimization is when the locus of value creation is in the hands of the individuals. Leaving the deterministic view that one or the other have causal powers is needed, if we are to provide meaning-full knowledge about the entanglement in the complex sociotechnical digital environment.

On a concluding note; IS research and practice should bring out the full potential of information technology in practice with positive consequences in organizational settings - the ultimate aim of IS-research and practice.

Problematizing the sociotechnical perspective is very relevant. As such, it seems as if the debate of sociotechnic has responded by bringing out the *hidden complexity by* bringing in *day-to-day practices* in digital environment.

The three roads forward [10] towards dualism, improvisation and interactions to the foreground in IS-research will reveal new aspects. But, will it embrace complexity?

Complexity, is when the phenomenon under study are dynamic, unstable and always changing; when there are emergent properties of interactions and unpredictability; when there is nonlinear interconnections and interdependencies [10].

The emergent way of thinking about complexity is that the world (including multiple realities) emerges in complex empirical and practical relations. This implies that we should inquire and intervene into these.

What we should aspire to... "is explore what kinds of simplifications need to be developed in order to cope, deal with, or navigate the concrete complex realities we are confronted with. Developing simplifications should not be equated with being simplistic. While being simplistic is tantamount to a reductionism, which dispenses with complexity, simplification allows us to plot a course through complexity. To put the question simply, how does one simplify without being simplistic? " [8, p. 779].

The question of the application *if* the sociotechnical perspective has been too simplistic in order to deliver clear answers to IS-designers. The many different forms of socio-technic i.e. eight different types of socio-technical approaches [10, p. 6-9] seems to support a perception of an IS-community engaged in [8] developing simplifications in order to plot a course through the complex world. Simplistic is when we close the box and arrive at one definite solution; while the reductionist view have been to simplistic, we arrive at the conclusion that that socio-technic is not closed box (even though different ontological assumptions exists). Simplifying is carving a road through complexity while still keeping the issue open for other roads and other solutions and other realities [8]. This is what [10] has done, and what we have aspired to do in this short theoretical paper.

While there seem to be a need for adjusting the lens to study (and improve) the understanding of practices in the complex dynamic environment of *working in the cloud*, we hope that we shed some light on an interesting discourse on how inquire into, and revisit core logics, to adjust the lenses we use as IS-researchers, instead of discarding them.

Appendix 5

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Double-edged Social Mechanisms at Work in the 21st century Information System: Opportunities and Challenges

Completed Research Paper

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Abstract

A long hold explanation in IS-Research is that any change in the Information System (IS), through the introduction of new IT-artefacts, trigger a chain of events leading to institutionalized routines and synchronized social practices. This explanation no longer covers the dynamic outcomes in the work-place set in motion by different types of IT-artefacts. We adopt a critical realist philosophy that entails to illuminate how IT-artefacts trigger social mechanisms in the human enterprise. We review IS-literature on the IT-artefact phenomenon from 2001 and forward. We find that the mechanism of individualization is forcefully triggered by new generative IT-artefacts, while enterprise IT-artefacts trigger institutionalization and socialization. We critically asses the opportunities and challenges this present for managers and designers when managing an IS that holds both types of artefacts. We draw a conceptual model of the now dual-IS, with double-edged mechanisms, that correspondingly can empower ambidextrous organizational forms.

Keywords: IT-artefacts, enterprise IT-artefacts, generative IT-artefacts, social mechanisms, critical realism, dual-IS

Introduction

The enterprise world has undergone tremendous changes in recent years, as evidenced by proliferating new theories in different areas of business management (Lee, 2016). New management and organizational theories has lately promoted theories of ambidexterity (O'Reilly and Tushmann, 2013). Kotter (2012) promotes a dual-structure in which both a hierarchy and a network serve as a holistic platform for organizing. These theories reflect the complex task of managing in the 21st century enterprise that involves holding an eye on both stability and agility; control and autonomy; long-term and short-term; exploitation and exploration. Basically these theories promote a simultaneous *both/and* approach to management (Smith, Lewis and Tushmann, 2016). In our opinion, the IS-discipline lacks a little behind in conceptualizing how the IS - seen as a holistic arrangement - supports this *both/and* perspective. Predominantly, because of a long hold focus on developing IS-theories in which the purpose of IT-artefacts i.e. enterprise systems, is to establish deep stable structures, through institutionalization (Currie and Swanson, 2009; Besson and Rowe, 2012; Avgerou, 2013).

Under the label "New Ways of Working" (NWOW) different types of technologies have recently entered the enterprise (Lee, 2016). Technologies denoting social, mobile, analytics and cloud (SMAC) capabilities. These have set in motion sequences of events that leads to increased autonomy (Mazmanian, Orlikowski and Yates, 2013) new work-modes (Legner et al. 2017) and looser organizational structures (Fischer and Baskerville, *forthcoming*). The ability of these technologies can best be described by the concept of generativity from Zittrain: "Generativity denotes a technology's overall capacity to produce unprompted change driven by large, varied, and uncoordinated audiences" (Zittrain, 2006, p. 1980). In the remainder of this paper we refer to generative IT-artefacts. Generative IT-artefacts distinguish from the enterprise IT-artefacts, in their malleability and varied outcomes. We suspect that these out-comes challenge long hold explanations: that users sharing same context and technology, after a while, find synchronous ways of interacting with the technology-in-practice (Orlikowski, 2000); likewise, that IT-artefacts impose and enforce stable and deep structures (Besson and Rowe, 2012). The differences in outcomes represent both challenges and opportunities. Challenges, if managers and designers assume synchronized practices and stable structures from *any* IT-artefact; and react with countervailing approaches, setting up strict work-flows, when autonomous sequences are set in motion; Opportunities if managers and designers act knowledgeable on how these forces complement and enable both stability and agility, just as the newer management literature on ambidexterity prescribes. Zammuto et al. (2007) argue the importance of developing IS-theories that reflect the changes in the phenomena we study, otherwise we risk that IS-theories become irrelevant.

In this conceptual paper, we set forward a discussion of the basic motors of change in the IS. We follow the advice from Avgerou (2013) who sees a need to "strengthen the explanatory capacity of IS-research, by developing causal claims by tracing social mechanisms that bring about IS phenomena" (ibid p. 400). The main purpose of this paper is to draw a conceptual and holistic model of the IS, that explains the social mechanisms that are triggered by different IT-artefacts. The task of tracing mechanisms in the IS, entails to contribute to a research practice, that can explain the outcomes of persistent innovation by uncovering phenomenon-specific causal paths in the human-technology interaction and the IS (Avgerou, 2013). This is the second purpose of this paper.

We apply a critical realist (CR) perspective. CR's core tenet is that the real world consists of mechanisms not events and that mechanisms combine to generate the flux of phenomena that constitute the actual states and happenings of the world. These events are caused by causative structures and mechanisms, and when new events happen, our theories about the workings of the world must be renewed (Bhaskar, 2008). We ask: *What are the social mechanisms beyond the IS and how can we explain the causal paths of how IT-artefacts trigger different outcomes in the IS?*

First, we must explain the concept of social mechanisms, how they work, and how they potentially trigger outcomes in the IS. Then we review IT-artefact literature, as a proxy of the flux of phenomena spanning a period of 16 years. We interpret to infer mechanisms and change over time. We observe four combinations of mechanisms that explain different outcomes related to the two meta-categories of IT-artefacts: enterprise IT-artefacts and generative IT-artefacts. As an exploratory exercise, we then draw a holistic model that illustrates the ambidextrous organization and the now dual-IS, and we focus on the layer of social mechanisms and outcomes. We discuss the practical importance of increased awareness of how mechanisms influence the IS and how this understanding can help IS-managers and designers, to create opportunities and tackle challenges, to enable ambidextrous organizing.

We have structured the paper as follows: In section 2, we give a brief account of social mechanisms and how they potentially can trigger outcomes in the IS. In section 3, we describe how we infer mechanisms from the chosen literature on IT-artefacts. We also describe the literature search. In section 4, we present the findings from the interpretation and draw an overarching model that simplifies the complex contemporary dual-IS. In section 5, we discuss the reality revealed and how it contributes to the IS-field. In section 6, we conclude by posing new questions.

Mechanisms at work in the IS

Asking what, why and how the IS change, are enduring questions in IS-Research. What triggers change? How does change occur? Why does it occur? These are different aspects of a very relevant question in the contemporary IS: how does the phenomena we study change? In a social system, change is often a ceaseless process of change governed by simple yet universal patterns (Van de Ven and Poole, 1995). These patterns are basic motors of change that can explain how and why changes unfold in the organization.

In different ways IS-scholars has contributed to answer these questions, by reviewing and studying drivers and affordances from different type of technologies. Lee (2016) study of smart technologies in relation to NWOW demonstrate such an effort. They demonstrate through a comprehensive systematic literature review, that an impressive amount of technological drivers has transformational impacts in the enterprise. Lee (2016) find 16 constructs at the individual level of which aspects such as independency, creativity, flexibility and control is found to drive transformation. At the organizational level 15 constructs are found, in which many of the same drivers from the individual level are inferred. Volkoff and Strong (2010) are obtained by the organizational changes set forward by the implementation of ERP-systems. They show how affordances are a specific form of generative mechanism and that "affordances are the generative mechanisms we need to specify" (Volkoff and Strong, 2010, p. 1). They find 19 specific affordances from a case-study using critical realism. They group them in four categories: 1) recording data, 2) standardizing and integration 3) visibility and 4) control. Similarly, Treem and Leonardi (2012) find four affordances, by reviewing case-study literature on social-media. They find: 1) visibility, 2) persistence, 3) editability, and 4) association, and suggest that the activation of some combination of these four will influence many of the processes in the enterprise that alters socialization, information sharing, and power processes in organizations. Henfridsson and Bygstad (2013) focus on three generative mechanisms 1) innovation, 2) adoption and 3) growth. These three mechanisms constitute and explain the success-full adoption and development of digital infrastructures in a case-study using critical realism.

We will contribute to these researchers work, and to the practice of tracing mechanisms in the IS. We will focus on social mechanisms as Avgerou states: "While social mechanisms thrive in IS theory they are rarely explicitly identified and mentioned in the theories" (Avgerou, 2013, p. 407). We apply a critical realist perspective in which the search is aimed at gaining an increasingly comprehensive and deep understanding of causal mechanisms i.e. the more basic forms of mechanisms that can be said to underlie other drivers and affordances in the IS.

According to Sayer (1992) looking for mechanisms entails that we ask into "the cause of something, 'what makes it happen' or, more weakly, what 'enables' or 'leads to it' " (Sayer, 1992, p.104.). Sayer (1992) also argues that particular interpretations (of causality) can only be justified in terms of their compatibility with our most reliable beliefs. Put another way, our interpretation of mechanisms in the IS rely on an assumption which, together with other assumptions, create a system of thinking about the world that we find acceptable. We must have reason to believe that what we study have the powers or liabilities to cause events to occur. As presented in the introduction institutionalization is one of IS-Research' assumptions. Our assumption is that this mechanism is halted or complemented by other social mechanisms not yet explicitly identified. In the critical realist approach mechanisms are seen as triggered causal powers (Gross, 2009).

When we study information systems, we often inhabit a systems perspective. Systems theory is used to understand the complexity of real situations, rather than analysing separated aspects (Ropohl, 1999). According to Ropohl (1999) specific causal mechanisms in a [socio-technical] system can best be described by the mechanisms of institutionalization and socialization. Ropohl (1999) presents two mechanisms that explains the outcome of a successful relationship between humans and technology in the IS. *Technical institutionalization* can best be described by the assumption that every technical product incorporates functions which prior has been a personal ability, knowledge and intention and thus inside a certain individual person. This is externalized and objectified in the technical system, and thus generalized beyond the individuals. This process of transindividual generalization of value and behavior patterns is called

institutionalization in sociology, and hence, technical development has to be understood as technical institutionalization (Ropohl, 1999). *Technical socialization* means the process of when institutions (in the abstract meaning), channel and shape the behavior of the individuals, and *integrate them into a common culture*, an effect which is called socialization in sociology. Formerly, this happened through human communication mainly, but nowadays technical products exhibit the same performance. When utilized within the IS, *the technology transfer their institutional power to the individual*. This mechanism is labeled technical socialization (Ropohl, 1999). When Orlikowski (2000) articulates that eventually synchronized behavior will emerge over time, we infer this as evidence of the powers institutionalization and socialization. When Avgerou (2013) indicates institutionalization as the mimic social mechanism underlying a vast amount of IS-theories, we draw the same inference. Evidently, these two mechanisms are assumed to be triggered, upon introduction of IT-artefacts in the human enterprise.

Mechanisms denote a linear causal process of change that produce the tendencies towards a specific change in the relational organization of a social order (Archer, 2015). However, each such tendency can be halted, suspended or distorted by the co-existence of other countervailing mechanisms. Archer (2015) argues, when the mechanisms are not triggered countervailing mechanisms can be in place that are triggered more forcefully (Archer, 2015). Hofkirchner (2014; 2015) describe a dialectic dynamic nature of social mechanisms that can explain such events. He identifies that the opposite of socialization is individualization. Actually, he indicates that they are both an end in a continuum. This continuum denotes a dialectic between individualization and socialization. He explains that members of societal systems are different individuals. Through their actions they bring about the formation of social relations that integrate. This in turn allows the individual to differentiate. The more individuals are individualized, the better they socialize (Hofkirchner, 2014; 2015). This mechanism holds the system together. Individualization in isolation, is a force-full social mechanism in society, denoting that people more and more act as individuated individuals not influenced by social norms and institutions (Castells, 2010). Individualization can, as a negative side effect, lead to egoism and isolation. Socialization can also trigger negative side effects, because it can lead to system-rigidity and inertia (Besson and Rowe, 2012). In both cases, the social system breaks down.

As said, mechanisms, however, "operate [only] when suitably triggered" (Gross, 2009, p. 62) and they coexist with a host of other mechanisms, processes, and factors that inhibit that triggering or otherwise interfere with the causal relationship. In critical realism (CR) the real exists independent of human thought. This reality consists of structures, mechanisms and entities that are unobservable. Their existence can only be observed trough the actual events that they cause. Critical realists make sense of the world, based on their understanding of the mechanisms that generate these events. On the other hand, critical realists can only experience the world, through empirical observations, which in nature are subjective. According to the CR ontology, generative mechanisms underlie the change of reality that may be contingently actualized and, perhaps, empirically identified by humans. The identification of mechanisms involves analytic movement across three ontological domains: from the empirical, where scientists access experience; to the actual, where they identify the events that generate that experience; to the real, wherein lie the causal mechanisms—usually unobservable. Bhaskar (2016) says *"theoretical explanation proceeds by description of significant features, retroduction to possible causes, elimination of alternatives and identification of the generative mechanism or causal structure at work"* (ibid, p 60). While we cannot directly study mechanisms, we must study the actual outcomes. The CR method of science is that of retroduction, in which the goal is to discover the interacting mechanisms and structures which generate a phenomenon (Mingers, Mutch and Willcocks, 2013). In table 1, we have collected the social mechanisms we propose to look for, representing a historically possibility of actually being real (Gross, 2009). We will look for the unidirectional mechanisms, but also the bi-directional mechanisms. The goal of critical realist research is to determine these proposed mechanisms and then eliminate some while supporting others (Henfridsson and Bygstad, 2013; Bygstad, Munkvold and Volkoff, 2015). In the following we present the methodology for conjuring the more universal social mechanisms triggered by IT-artefacts, over the cause of 16 years.

Table 1. Mechanisms and outcomes

Unidirectional mechanisms and outcomes	
Technical institutionalization Technical socialization	When the particular IT-artefact theory and description of features displays effects/intentions of institutionalization and socialization i.e. shared ways of working.
Technical individualization Technical diversity	When the IT-artefact denotes different outcomes, individualized behaviors and increased autonomy. When the IT-artefact is malleable and denotes generativity.
Bi-directional mechanisms and outcomes	
Integration & diversity Socialization & Individualization	When the particular IT-artefact *theory* displays effects of the dialectic nature between integration and diversity and socialization and individualization.

Method

We have chosen to interpret the social mechanisms underlying the flux of the IT-artefact phenomena in the 21st century enterprise as studied and reported by fellow scholars within the IS-research community. More specifically, we seek descriptions specifically covering a theoretical definition of what constitutes an IT-artefact. In 2001, Orlikowski and Iacono, call for research that view technology as artefacts, not just as objects, denoting an understanding that IT-artefacts are not universal or neutral, they are embedded in their context, made of fragments and are neither fixed nor independent (Orlikowski and Iacono, 2001). This call inspired other researchers to contribute to the *IT-artefact theorizing* trajectory. We are interested in reviewing these articles, because the layer of the actual, consists of our theories of how the world works. Logically, when the mechanisms that caused the theories in the first place, change, then our theories must change as well (Bhaskar, 2008). This entails that *when-ever* a new theory of the IT-artefact surface, the mechanism must have changed or mechanisms must combine in new ways.

Literature search

A manual search (in October 2016) first in AIS Journals and Conference Proceedings[1] with the word "IT (technology/digital) + arte(i)fact (s)" in titles, abstracts and keywords, and after closer scrutiny yielded 22 relevant articles published from 2001 – 2016. Two additional searches were carried out with the same search term and search criteria. One in Google Scholar. This yielded two more articles marked with italic in table 3. The entire sub-set of articles cover 23. We did conduct a similar search in Journal of Organizational Science. None matched the search in titles, abstracts or keywords. When applying "everywhere" only 6 papers matched. One was relevant to the RQ, but was already covered in a MIS Quarterly paper.

As an example of a paper that met the inclusion criteria of *IT-artefact theorizing* is Benbasat and Zmud (2003). Herein an IT-artefact is defined as"…the application of IT to enable or support some task[s] embedded within a structure[s] embedded within a context[s]" (ibid, p 186) and theorized to exhibit backwards and forward causation on usage and management. A text that did not meet the inclusion criteria was from Currie and Swanson (2009). Even though the term IT-artefact is in the title and in the abstract, the IT-artefact is only used in the last sentence of the paper. It is used as an umbrella term, to cover different IT-systems and technologies. No definition or development of the IT-artefact theorizing was explicated. Table 2, is an overview of the 23 selected papers. They all represent a contribution to the *theorizing of IT-artefacts*.

Table 2. Overview of papers

#. Author (s) Year of origin; short title and outlet
1. Orlikowski and Iacono, 2001. "Desperately seeking the IT-artefact". Inf. System Research
2. Kallinikos, 2002. "Blackbox of technology artefacts and change". ICIS proceedings
3. Benbasat and Zmud. 2003. "The identity crisis within the IS-discipline" in MIS Quarterly
4. Alter, 2003. "Sidestepping the IT-artefact" in Comms. of Association of Information Systems
5. Mazino and Zamarian, 2003. "IT artefacts as structuring devices". Interact. with Computers
6. Whinston and Geng, 2004. "The essential role of the IT Artifact in ISR". MIS Quarterly
7. Agarwal and Lucas. 2005. "The IS-Identity Crisis" in MIS Quarterly
8. Alter, 2006. "Work-systems and IT artifacts" in Comms of Association of Information Systems
9. Chiasson and Green, 2007. "Questioning the IT Artefact: user practices" European Journal of IS
10. Matook and Brown, 2008. "Conceptualizing the IT Artefact" in ICIS proceedings
11. Caroll, 2008. "Theorizing the IT artifact for Mobility" in ICIS Proceedings
12. Evermann and Tate, 2009. "The lost world of the IT-artefact" in Journal of Ass. of Inf. Sys.
13. Ponto, Rossi and Zamarian, 2009. "Coop. design for the complex IT-artefact". IT and People
14. Nevo, Nevo and Ein-dor, 2009. "Core artefacts" in Comms. of the Association of Inf. Systems
15. Strong and Volkoff, 2010. "A path to theorizing the IT-artifact" in MIS Quarterly
16. Agresti, 2011."Toward an IT agenda" in Communication of Association of Information Systems
17. Zang, Scialdone and Ku, 2011. "IT Artefacts and the State of IS Research" in ICIS proceedings
18. Robey, Anderson and Raymond, 2012. "IT, Materiality and Change" in Jour. Ass. of Inf. Sys.
19. Lee, Thomas and Baskerville, 2013. "From the IT artefact to the IS artefact" in AMCIS proc.
20. Reimer and Johnston, 2014. "Rethinking the place of the artefact in IS" in Eur. Jour. of Inf. Sys.
21. Eck, Uebernickel and Brenner, 2015. "Generative capacity of digital artifacts" in PACIS proc.
22. Alter, 2015. "The IT-artifact has outlived its usefulness" in Comms. of the Ass. of IS
23. Nevo, Nevo and Pinnensault, 2016. "Self-agency theory and IT-reinvention" in MIS Quarterly

The distribution over years, of the 23 articles is very consistent with one to three every year. This distribution exhibits a consistent interest in theorizing about the IT-artefact from 2001 and forward. Out of the 23 articles 15 articles comes from respected IS-journals (1 from ISR, 5 from MIS Quarterly, 5 from CAIS, 2 from JAIS and 2 from EJIS), 2 articles from other relevant journal out-lets: Information Technology and People; and Interacting with Computers. We selected 6 articles from conference proceedings (4 from ICIS, 1 from AMCIS and 1 from PACIS).

Interpretation and explanations

In the social sciences, explanation takes the form of breaking events down into elements, identifying the mechanisms that generate them, and determining, through empirically grounded reflection on the conditions of historical possibility, whether and how those mechanisms brought about the events (Gross, 2009). The cornerstone of realism is a distinctive viewpoint on how interventions bring about change. It is only by understanding and probing into the change that one can evaluate a theory. According to realist evaluation, sequences are theories, they are embedded and active (Pawson et al., 2004). Realist evaluation stresses four key linked concepts. The mechanisms describe what it is about the theory that bring about any effects. Identifying the sequence is the first step, while context describes those features of the conditions in which the sequence is introduced that are relevant to the operation of the mechanisms. Lastly, outcome-patterns comprise the intended and unintended consequences of theories, resulting from the activation of different mechanisms in different contexts. Thus we seek to convey the "context-mechanism-outcome pattern configuration" (Pawson et al., 2004 p. 6). In table 1 we presented the mechanisms that most likely will cause different outcomes in the context of the 21st century enterprise.

Inferring mechanisms is an iterative and creative task (Bygstad, Munkvold and Volkoff, 2015). We analyzed each paper several times. We asked: What changes can we infer from the new IT-artefact theory? Which new events, new conditions and/or new observed dynamics are highlighted in the IS, that need theoretical elaboration? This gave a general understanding of the change motivating each article. Then we asked: How is the change related to the IT-artefact? Can we derive a sequence? Are changes intended or un-intended? What mechanisms from table 1, can possibly and most reliably be the cause of these outcomes?

We inferred 4 different ways of how these mechanisms combine to produce outcomes from the implementation of the IT-artefact in focus. The interpretation and retroduction of mechanisms from table 1 are highlighted with different shades of grey in appendix A. In table 3, we explain four categories, denoting how mechanisms combine and produce certain outcome patterns over the course of 16 years. The first category represent 8 IT-artefact theories that explain outcomes, caused by mechanisms of technological socialization and institutionalization; The second combination represent other 8 IT-artefact theories that explain how the IS evolves more rapidly responding to the environment, based on a combination of different types of enterprise systems and applications, that trigger socialization, institutionalization and integration. The third combination represent 5 theories showing that mobile and generative IT-artefacts trigger individualization and diversity in the IS. The fourth combination are found in two theories that mirrors bi-directional mechanisms.

Table 3. The four combinations of IT-artefact outcomes

1. Enterprise IT-artefacts trigger institutionalization and socialization (2001-2015)
The first combination, are theories of IT-artefacts that holds institutionalizing and socializing purposes, supporting the socio-technical system understanding of how main mechanisms create a well-functioning system. Orlikowski and Iacono (2001) define IT-artefacts as "…those bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software" (ibid, p. 121) as such they are not universal or neutral and embedded in their context. Benbasat and Zmud (2003) define IT-artefacts "as the application of IT to enable or support some task(s) embedded within a structure(s) that itself is embedded within a context(s)" (ibid, p. 186) and underline the importance of understanding the causality between context, structure and tasks as IT becomes artefacts embedded in routines, norms and values. In Mazino and Zamarian (2003) IT-artefacts are conceived as negotiated, embedded, and sedimented sets of rules and can be seen as vessels carrying the rules influencing users' behavior. Even though Alter (2003; 2006) subscribe to IT-artefacts as tools, they are integrated parts of the work-system, with the purpose of creating competitive advantage and productivity. In Volkoff & Strong (2010) IT - artefacts imposes a structure to work; that are intentionally designed into the Enterprise Systems (the focus of their study). Just as socialization follows institutionalization (Ropohl, 1999). Volkoff & Strong (2010) find that new latent structures of a social nature arise as second order structures. These structures are organizational culture, roles and control-mechanisms. This structural approach to technology is supported in Robey, Anderson and Raymond (2012) in which IT-artefacts denote structure, but also a perception, because IT-artefacts are embedded in routines that are vital to the organization. Alter (2015) describes an IT-enabled work system in which human participants and/or machines perform processes and activities using information technology to produce products and services.
2. The IS consists of diverse IT-artefacts, that combine and trigger institutionalization (2004-2011)
In the second combination we see IT-artefacts that intentionally trigger institutionalization, socialization and integration, but also holds a variability in relation to different roles and purposes in a more complex and networked IS. Whinston and Geng (2004) describe IT-artefacts as evolving rapidly and innovatively, driven by business intent and strategies. Lucas and Agarwal (2005) explains how IT-artefacts are "…the integration of the processing logic found in computers with the massive stores of databases and the connectivity of communication networks" (ibid, p. 394). Martook and Brown (2008) map a diversified IT-artefact landscape, and describe four IT-artefacts with different roles and purposes in the IS. Some

are open and dynamic to change (Knowledge Management Systems and Business Intelligence) others are closed and static (Decision Support and Enterprise-IS). In general, IT-artefacts are defined as systems or applications in a larger system, with distinct purposes, that compliments each other and facilitates the enterprise in achieving its goals. Nevo, Nevo and Ein-dor (2009) conclude that the "IS discipline has a central and enduring core, which, while not completely static, may be characterized by persistent attention to a small set of IT Artifacts and a similarly small set of IS […] this enduring focus […] reflects on our discipline" (ibid, p. 234). The focus being on decision support, enterprise systems, infrastructures and collaboration tools, triggering institutionalization, socialization and integration. Evermann and Tate (2009) points to the importance of designing artefacts that are based on knowledge of human psychology, so that each individual can create relevance at the operational and actionable level in a work-system. Ponto, Rossi and Zamarian (2009) explores how users cooperate when designing an IT-artefact and eventually how this impact the relationship between the IT-artefact and organizational structuration. Agresti (2011) takes a more pragmatic view and describe the IT-artefact as a phenomenon that encompass all the elements that are involved with the practice-use of technology in work, enabled by information processing capabilities. IT-artefacts consists of physical systems, hardware, software, tools, techniques, methods, policies, protocols, methodologies, and practices which make up the information system. Zang, Scialdone and Ku (2011) take stock of the IT-artefact in IS research and describe IT-artefacts as "an entity/object, or a bundle thereof, intentionally engineered to benefit certain people with certain purposes and goals in certain contexts. It is developed, introduced, adopted, operated, modified, adapted, discarded, and researched within contexts and with various perspectives" (ibid, p. 3). Thus we infer IT-artefacts have various purposes that combines to full-fill the strategic intent of the enterprise.

3. Generative IT-artefacts trigger individualization and diversity (2008-2016)

The third combination denotes theories of IT artefacts that in important ways reflect the existence of *the individualization mechanism* at work in the IS. We identify that individualization and diversity are triggered and combine in ways that lead to new hierarchies, structures and functions in the IS. The outcomes are rapidly changing and evolving systems of systems, that leads to looser structures and network formations. Carroll's (2008) study of mobile technology theorize that IT-artefacts, previously fixed in a specific physical context, are now adopted by individual mobile workers, who constructs a portfolio of technologies, where use is diverse and unexpected. These workers have a temporal orientation towards the situation that determines the individualized portfolio in the moment. The IT-artefact can no longer be viewed as a single stranded design with a defined purpose, instead it evolves rapidly, increasing diversity and it is operated by the individual user (Carroll, 2008). Reimar and Johnston (2014) describes these outcomes a little differently and see IT as equipment used-in-practice. They explain, that the use of IT is conceived as the appropriation of IT into a holism of other equipment, work practices and user identities. This view replace the understanding of IT artifacts, as a bundle of features or properties and it dissolves the linear cause and effect that dominates the IT-artefact theorizing in combination 1 and 2 between design, intent and use. Practices and equipment are constitutive of the self to the degree that individuals express their (professional) identities through the equipment they use. Lee, Thomas and Baskerville (2013) advocate that IT artefacts must in fact be seen as IS artefacts that holds information, technology and social constructs created by individuals and groups. They view an IS as made-of any number of individual and collective IS-artefacts. Nevo, Nevo and Pinnensault (2016) calls this re-invention of technology and finds, just like Carroll (2008), that changes are continuous and short-termed. Individuals change technology to perform better and to master work. Temporally situated self-agency is driving the adaption in pursue of a goal, changing the purpose and intent embedded in the technology that supports a task. Eck, Uebernickel and Brenner (2015) introduce the concept of generativity as the capacity of a technology or a system to be malleable by diverse groups and actors in unanticipated ways. Innovation brought about heterogeneous groups of actors is universally regarded as the goal of generativity, but it also represents the possibility of exploiting generative systems towards other valuable ends such as organizational agility. The outcomes are complex, networked and evolving systems in systems.

4. Integration and socialization/diversity and individualization (2002-2007)
Two articles describe theories of IT-artefacts that mirrors outcomes from the bi-directional mechanisms denoting diverse agents that bring about a structure that integrates; this structure leads to socialization that in turn leads to individualization. Kallinikos (2002) puts word to these mechanisms by saying that IT-artefacts must predominantly be a part of individual sense-making and appropriation. IT-artefacts are first and foremost created by humans in a social but defining setting. Likewise, inscription of technology by designers may be either deterministic and detailed, or emergent and general (Chiasson and Green, 2007). Kallinikos (2002) describes different degrees of controls, denoting IT-artefacts as being everything between very malleable to very predictable. Some IT-artefacts are sketches for work, inviting actors to mend and fit the technology; some are scores open to interpretation while imposing some form of predictability in outcomes. Others such as Enterprise IT-artefacts represent stricter scripts for work. The theories cover different outcomes from different IT-artefact that most likely trigger socialization and individualization at the same time. We did not categorize Martook and Brown (2008); Lee, Thomas and Baskerville (2013) or Eck, Uebernickel and Brenner (2015) in combination 4. However the theories do hold a *both/and* perspective that possibly supports both processes and practices, and enable agility and stability.

Overall, the four combinations of mechanisms constitute a larger narrative of causal paths in the 21st century digital workplace. From the theorizing in category 1, we conclude that IT-artefacts that hold enterprise scripts with specified purposes and intentions trigger technological institutionalization and socialization. The power of these mechanisms does not seem halted. They endure from 2001-2016. During the period from 2003 - 2011 the theorizing in combination 2 involves technological innovation. Various and more tasks are supported by different IT-artefacts, thus concurrent enterprise information processes and practices with strategic intent combines and integrate in the IS. This entails that we can theorize that the meta-category of the enterprise IT-artefact trigger unidirectional mechanisms of first and foremost institutionalization, socialization and integration. 16 articles hold this perspective. In 2008 and forward, new digital technologies of mobility and connectivity enters the theorizing. In combination 3, we observe that outcomes are now oriented towards the individual user, short-termed and fast changing. These outcomes influence hierarchy, structure and relations through the mechanisms of technological individualization and diversity. These outcomes are generative. Thus the other meta-category of generative IT-artefact is now theorized to trigger unidirectional mechanisms of individualization and diversity. This perspective is mirrored in a smaller number of articles from 2008. We ascribe the fewer theories of generative IT-artefacts the fact that they have arrived more recently and as such, represent 5 out of 13 articles, since 10 articles were produced before Carrol (2008) and 12 after. Combination 4 covers two articles from 2002 and 2007 with theories of dynamic outcomes arising from a more holistic view inhabited by both types of IT-artefacts, triggering bi-directional mechanisms. Despite the limited number representing this perspective, we make the logical inference that bi-directional social mechanisms are most likely triggered in the IS. However, we categorize it as under-researched.

The larger narrative signifies a reality in which out-comes, predominantly from unidirectional mechanisms, are observable. The forces from bi-directional mechanisms are less observable, but they most likely combine, and are triggered concurrently by the two different meta-categories of IT-artefacts in the IS: 1) enterprise IT-artefacts with aspects of predictability, fixed within an enterprise context, defined by purpose and supporting a process, that triggers socialization, institutionalization and integration. 2) Generative IT-artefacts, with aspects of malleability, flexibility and agility, and supporting the day-to-day practices that trigger technological individualization and diversity. Both meta-categories of IT-artefacts inhabits the 21st century workplace. IT-artefacts work side by side and produce outcomes in what we now label as a dual-IS. As an exploratory exercise we draw a model that visualize the layer of social mechanisms, the IT-artefacts and their outcomes. We combine them with the present perspective of the ambidextrous organization from Kotter (2012) and Smith, Lewis and Tushmann (2016).

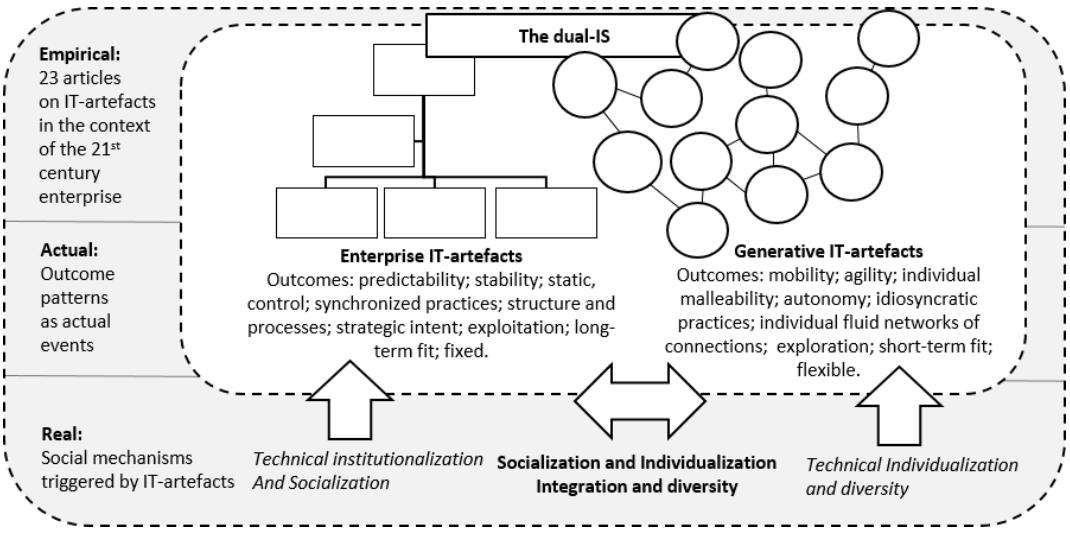

Figure 1. The dual-IS and social mechanisms in the 21st Century Organization

The model of the dual-IS in figure 1, shows how two meta-categories of IT-artefacts support two different but important organizational platforms in the ambidextrous organization: that of a hierarchy (the left side in the white box) and that of a network (the right side of the white box). It pictures the possible explanation of how generative IT-artefacts trigger the social mechanisms that set in motion sequences of technical individualization and diversity among actors, with outcomes of individual fluid network-like structures, speed, agility, autonomy, thus supporting exploration in the ambidextrous organization. Simultaneously the enterprise IT-artefacts, trigger socialization and institutionalization in the more stable and hierarchical part of the ambidextrous enterprise, with outcomes supporting exploitation. These apparently contradictory mechanisms possibly enables and enforce each-other through the bi-directional social mechanisms represented by the white arrow in the middle. In figure 1, the three strata from critical realism are highlighted in the grey area. The articles served as the empirical layer, the outcomes described are the actual layer, and the layer of the real, are the social mechanisms that most likely will be triggered. In the following we discuss the contribution and the practical and theoretical implications derived from this interpretation.

Discussion

Our review contributes to approaching opportunities and challenges in the digitilized enterprise. Specifically, it contributes in five key ways.

First, we inferred the real layer of mechanisms that are triggered by the implementation and adoption of different types of IT-artefacts in the 21st century workplace. As such we contribute to the discussion of mechanisms and causal paths in IS (Avgerou, 2013).

Second, Lee (2016) study of smart technologies, Treem and Leonardi (2012) study of social media, Henfridson and Bygstad (2010) study of digital infrastructures and Strong and Volkoff (2010) study of ERP-system are examples of research answering the question of possible causal paths by focusing on affordances, drivers and generative mechanisms in relation to *one* specific IT. Our study focus on the social mechanisms beyond these levels triggerede by two meta-categoris of IT-artefacts. As such we contribute to, extends and elaborate prior work by looking at the more universal social mechanisms that are triggered and set in motion by the human-technology relationship.

Third, As Van de Ven and Poole (1995) we infere universal patterns that are the most likely explanations to the dynamic and complex forces at work in the enterprise. Our findings contributes with an IS-domain specific perspective and explanation on how technology implementation aimed at individual practices and

at organizational proceses trigger outcomes that the theory of ambidexterity seek to deliver (O'Reilly and Tushmann, 2013). As such we deliver an IS-elaboration path that mirrors the management-literature on dual-systems (Kotter, 2012) and *both/and* thinking (Smith, Lewis and Tushmann, 2016).

Fourth, as critical realists we understand the world in different strata, and by parting the world into the emperical, actual and real, it is posible to keep a clear focus on the social mechanisms beyond drivers and actualized affordances from specific IT-artefacts otherwise operating in the enterprise. The critical realist approach reveals a reality in the human enterprise where a few basic mechanisms are triggered simutanously by two different meta-categories of IT-artefacts in the IS. Our retroduction of social mechanisms at work in the IS serves as a particular explanation of causality that are compatible with reliable beliefs from the field of philosophy of technology (Ropohl, 1999; Hofkirchner, 2014;2015).

Fifth, and most importantly, our review reveals a new dimension of the dynamic work-place and serves as *a most likely* explanation as to why the former explanations, of how IS-change follows unidirectional mechanisms of institutionalization and socialization, no longer holds. We have shown that the opposite side of institutionalization and socialization are now triggered, by the more recent entrence of generative IT-artefacts with outcomes that can be explained by the mechanism of individualization. When viewed in a larger picture we surmise that the bi-directional mechanisms hold the now dual-IS in balance. But only if the mechanisms are properly and proportional activated. A present and future challenge will be to tackle these mechanisms, so that the system does not become overtly rigid and strict - resulting in inertia and stagnation; or overtly loose – resulting in chaos and no-direction. The opportunities of a well-functioning dual-IS lies in how well these double-edged mechanisms are trigged - and set in motion - to secure both stability and agility. Thus it relies on how well a *both/and* perspecitve can apply to IS-activities. This will become increasingly important to IS-managers and IS-strategists.

Our study has several limitations. Our model of the contemporary IS and its mechanisms are conjured from other scholars polished work on the IT-artefact and on the basis of few but influential works on social mechanisms relevant to field of technology philosophy and the information society. Our inclusion criteria of IT-artefacts in titles, abstract and keywords, is narrow. The word IT-artefact is often not used in articles, instead papers mention the specific type of IT/ES. While theory and conceptual development from literature reviews are a traditional research activity, our paper present a weakness of reliability of the inferences. Inferences are basically subjective and in this case they are based on 23 articles and a single author's interpretation. Going forward we will expand the search to include works outside of AIS, include more researchers and expand the search to other inclusion criteria. We will also conduct a systematic review of social and generative mechanisms in the IS in order to elaborate and develop the subset of mechanisms that we have retroduced.

Conclusion

The purpose of this paper was to contribute to a renewed understanding of the motors of change, by presenting a model that includes the level of social mechanisms at work in the 21st century enterprise. The model explains how different mechanisms are triggered by different types of IT-artefacts in the IS. This knowledge is use-full for scholars researching new theories about the changing workplace, and it can be use-full for designers, managers and strategists when they plan and explain expected successful outcomes from their *interventions* into the complex current dual-IS. The model of the dual-IS can also help managers to succeed in delivering on both stability and agility from there IT-artefact interventions.

Many questions are still unanswered. We suggest further research that can answer the following: How does individualization affect the relations and structures in the IS? Will ever more differentiated individuals, integrate into looser structures that eventually becomes to lose? Will the response from managers be to create ever more strict structures, thus producing negative outcomes from halting the activation of the double-edged mechanisms? How do we trigger the bi-directional outcomes of agility and stability in a 21st century enterprise? How is balance achieved? We invite other scholars to answer these questions with us.

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Appendix A. Mechanisms and nature of IT-artefact

Paper	**What IT-artefacts**	**Mechanisms**					
Year and Authors	Unspecified/specified; Intended or generative	TS	TI	ID	SI	I	D
2001 Orlikowski and Iacono	Unspecified-intended						
2002 Kallinikos	Both/and, intended/generative						
2003 Benbasat and Zmud	Specified/intended						
2003 Alter	Unspecified/intended						
2003 Mazino and Zamarian	Specified/intended						
2004 Whinston and Geng	Unspecified/intended						
2005 Lucas and Agarwal	Unspecified(intended						
2006 Alter	Unspecified/intended						
2007 Chiasson and Green	Specified/intended and generative						
2008 Matook and Brown	Specified/intended and generative						
2008 Caroll	Specified/generative						
2009 Evermann and Tate	Specified/intended						
2009 Ponte, Rossi and Zamarian,	Specified/intended						
2009 Nevo, Nevo and Ein-dor	Specified/intended						
2010 Strong and Volkoff	Specified/intended						
2011 Agresti	Unspecified/intended						
2011 Zang, Scialdone and Ku	Unspecified/intended						
2012 Robey, Anderson and Raymond	Unspecified/intended						
2013 Lee, Thomas and Baskerville	Unspecified/generative						
2014 Reimer and Johnston	Unspecified/generative						
2015 Eck, Ûbernickel and Benner	Unspecified/generative						
2015 Alter	Unspecified/intended						
2016 Nevo, Nevo and Pinnensault	Unspecified/generative						

Legend. *Paper:* Year of publication and authors. *Unidirectional mechanisms*: TS: technical socialization; TI: technical institutionalization; I: technical individualization; D: technical diversity. *Bi-directional mechanisms*: ID: integration and diversity; SI: socialization and individualization.

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Revising the Socio-technical Perspective for The 21st Century: New Mechanism at Work

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ABSTRACT

A predominant understanding in information systems research is that technology has institutionalizing and socializing effects in its interaction with humans in the human enterprise. This understanding no longer gives a full account of the dynamics in the current workplace. Through a critical realist approach, the socio-technical mechanisms in the 21st century global enterprise is re-explored, through a study of 18 user's productive behavior afforded by Unified Communication and Collaboration (UCC). The study finds that the mechanism of individualization is the cause of events that profoundly change the socio-technical reality. Individualization affects how people relate to one-another and reduces the influence of the organization as a system. The power of individualization creates a new parallel structure of small networks of close colleagues. The study shows the dialectic nature of mechanisms in a socio-technical system and provides a social system perspective of the dynamic individualization forces that now inhabit the self-organization of a complex socio-technical system.

KEYWORDS
Socio-Technical Perspective, Critical Realism; Mechanisms, Unified Communication and Collaboration, Individualization, Socialization

INTRODUCTION

For much of the past research in information systems (IS), the people who interact with information technologies have been regarded in collective and in general ways: as a member of a group of users; as a member of a group of adopter etc. *The system user* was less an individual than an abstract representation of an entire group of users. Accordingly, the notion of sociotechnical systems grew to account for the social nature of the people-technology interaction. This *sociotechnical perspective* accepts that, in important ways, people interact socially with each other and with their technology (Mumford, 2006). This notion of the importance of any social collective of people and their technology is growing less relevant to the way many people are interacting with their information technologies. Society has changed considerably due to digitalization and globalization (Castells, 2010). Alongside these dominant forces, individualization has emerged as a powerful basic form of human behavior. *Individualization* entails the freedom to use one's own resources (Castells, 2010; Baumann, 2011) and to have an individual approach to change (Baumann, 2011). Having control and *freedom to choose* has shown significantly to affect human behaviors (Mazmanian, Orlikowski & Yates, 2013). For example, individualization reduces the influence from a system, and generates – consequently - fluid social networks (Baumann, 2011). But, individual*ization* can lead to individual*ism*, which is a critical issue. Individualism is a personal exaggeration that detracts from sociality instead of enhancing it. Individualism can alienate humans from each other; some enriching themselves at the expense of others while diminishing the overall community and thereby impoverishing everyone (Hofkirchner, 2014).

The interest is to explore the impact of individualization in the current work-place and how the (apparently) more individualized individual – as opposed to the more socialized individual – influences the Information System in the 21st century.

A key concern in IS-studies is to explain the consequences of the interactive relationship between new technology and new human action (Hirschheim & Klein, 2012; Grover & Lyvtinen, 2015). Technologies have many different meanings, capabilities and uses. They have multiple, emergent, and dynamic properties, as well as transformational powers in the various social worlds in which they are embedded (Orlikowski & Iacono, 2001). Studies often subscribe to a system view (Lee, 2010) and to a view that technology has institutionalizing, socializing and routinizing powers in the human enterprise (Robey, Anderson & Raymond, 2013). IS are often studied in a socio-technical perspective (Lee, 2010; Robey et al, 2013; Grover & Lyvtinen, 2015) with an inherent ontological distinction between technology and its social context (Robey et al, 2013). As such, the research has an ensemble view of the interactive relationship between people and technology in a system (Orlikowski & Iacono, 2001). Technologies are introduced into the human enterprise with many intents. The intended outcome of different technologies in a social system, can best described by its spirit (DeSanctis & Poole, 1996). The spirit represents the general intent of the designer, a reflection of the values and goals that underlie the structures in a technology. As an example: ERP systems have the spirit of standardizing input (Strong & Volkoff, 2010); CSCW has the spirit of teamwork (Blackler, 1994); Knowledge Management Systems have the spirit of codification or personalization (Hansen, Nohria, & Tierney, 1999). Recently, new technologies, with a spirit of mobility and connectivity**,** have entered the workplace (Hirschheim & Klein, 2012). UCC is an example of such a new technology. UCC gives people the opportunity to connect with colleagues from anywhere, anytime, and on any device. They are easy to use, not tied to mandatory use, and they are not laden with a specific workflow (McAfee, 2006). The purpose is often to enhance productivity in knowledge work in global organizations (Silic & Bach, 2015). Productivity in knowledge work requires autonomy (Drucker, 1999) and we surmise that these new technologies afford autonomy. *Affordances* represent a person's readily perceivable possibilities for action (Norman, 1998) and we suspect that the possibilities for autonomous and individual actions will have likewise effects on the socio-technical system, as individualization has in society.

The purpose of this study is to explore and explain, from a critical realist position, the affordances in new technologies with the spirit of mobility and connectivity and if new mechanisms are influencing the socio-technical work-system. We ask, *how does the range of new technological affordances affect the relations between individuals within the organization? How does it change the mechanisms in the socio-technical system?*

We contribute with a new socio-technical perspective that echoes the reality in the 21st century enterprise. This work is significant to anyone engaged in explaining socio-technical work-practices, as a subset of human behavior in the workplace. This include both managers, researchers and practitioners.

We have ordered the paper in the following way: in section 2, we present the literature review. In section 3, we present the methodology. In section 4, we present the findings from an exploratory case study, and in section 5, we discuss the findings. In section 6, we conclude.

LITTERATURE REVIEW

An *individuated individual* may seem tautological, but it refers to one who has become more of an individual through available affordances. There is only a sparse IS Research literature that takes a socio-technical system perspective while dealing with ways in which the individuated individual interacts with IS. We used a systematic approach to search for articles in the top-ranking journals, within the IS-community. We searched the AIS Senior Scholars' Basket of Eight[1] journals using Proquest's ABI/Inform Collection[2]. We used the search terms: individualization AND/OR individuated AND/OR individual AND socio [-] technical. This search yielded 54 matches. After reading titles, abstracts and keywords, we selected 22 articles for scrutiny. After categorizing and reading the whole set of articles, we found 16 articles relevant.

For IS-Scholars, the common object of study is the relationship between "individuals", "technology" and "information" in an organizational setting (Hirschheim & Klein, 2012). We usually refer to this as an Information System (IS). ISs *per se* involve information technology and a social system (Hirschheim & Klein, 2012; Lee, 2010). Most IS studies treat "systems" as anything involving IT (Lee, 2010, pp 339). A more sustainable view recognizes two constituent sub-systems: a technological system (hardware, software, networks and data) and an organizational system (the business firm, division of labor, distinct culture, reward system and processes). These sub-systems interact in an upwardly moving adjustment and change in order to meet ever-new requirements produced from each subsystem and the environment (Lee, 2010). Core assumptions are that socio-technical systems have an equilibrium, in

[1] http://aisnet.org/?SeniorScholarBasket

[2] http://www.proquest.com/products-services/abi_inform_complete.html

which the two sub-systems exist in harmony - a state that delivers on economic and human objectives (Licker, 2005). Equilibrium is produced when features in new technologies play an institutionalizing and routinizing role in the organizational-system (Lee, 2010). The consequent improved and socialized behaviors lead to better performance of the IS as a whole (Luna-Reyes. Zhang, Gill-Garcia, & Cresswell, 2004). Equilibrium (as opposed to non-equilibrium) thus exists in punctuated periods of time (Licker, 2005).

IS research "typically sees organizations as collections of individuals" (Lee, 2010, p. 342). The selected research refer to the individual, in various ways of collectives: "performing collective activity" in Blackler (1994). "A part of localized adaptation" in Luna-Reyes et al (2004). "Stake-holders" and "participants and customers" in Alter (2015). "Users of technology" in Söllner. Hoffmann, & Leimeister (2016) and Skågeby (2010). "Agents" in Lee (2010), Licker (2005), Orlikowski & Barley (2002) and Grgegic, Holter, & Rosenkrantz (2015). Finally as "human actors" in Beynon-Davies (2010) and Bélanger, Cefaratti, Carte, & Markham (2014).

The set of articles from the literature search reflect four distinct views of the individual as related to, and situated in, a socio-technical system. In table 1, we present these four views: the design view, the emerging view, the unifying view and the inertia view.

Table 1. Four views of socio-technical setting and drivers, related to the individual

Setting / Driver	Individuals are the system's setting	The system is the individual's setting
Socio-technical structures drive individual behavior	1. The design view include articles from Lee (2010); Licker (2005); Pipek & Wulf (2009); Skågeby (2010); Alter (2015); Söllner et al. (2016).	2. The emerging view include articles from Blacker (1994); Orlikowski & Barley (2001); Luna-Reyes et al. (2004); Lee (2010); Grgegic et al. (2015)
Socio-technical integration patterns drive individual behavior	3. The unifying view include articles from Lee (2010); Beynon-Davies, (2010); Bélanger et al (2014)	4. The inertia view include Besson & Rowe, 2012)

These views differ in two key ways. First, there are contrasting assumptions about the relationship between the individual and the system as to which constitutes the setting for the other. Some works assume that the individual constitutes the setting for the system (i.e., the design and unifying view). Others assume that the system constitutes the setting for the individual (i.e., the emerging and inertia views). Second, there are contrasting assumptions about how socio-technical systems affect individual behavior. Some works assume that socio-technical structures drive individual behavior (i.e., the design and emerging views). Other works assume that socio-technical integration patterns drive individual behavior (i.e., the unifying and inertia views). We discuss each of the four views in detail in the sections below.

The design view

The theory-in-use, in the IS-community, is rooted in Methodological Individualism (Lee, 2010). Methodological Individualism is the position that the individual ultimately determines behaviors, actions, thoughts, motivations and the well-being of an individual (Lee, 2010). This position, translates in IS research, into a view in which the individual constitutes the setting for the system. The main assumption is that extensive knowledge of user behaviors and motivations can inform the design of socio-technical structure that eventually drives individual behavior. The position assumes that we can design productive and value-creating socio-technical structures (Hirscheim & Klein, 2012; Pipek & Wulf, 2009; Alter, 2015). This view has diverged into different lines of research on: (a) how individuals accept (and use) technology, (b) participatory design in IS, (c) work-systems, and (d) on how to best implement new technologies in the organization. A predominant question is how do you improve a design of IS in such a way that it is more readily accepted by users. Our literature search included a study of how trust-relationships affect user acceptance in social media (Söllner et al, 2016). Another studied how gift giving as a general theory can prove valuable when showing social intention in online communities (Skågeby, 2010). Other works considered how knowledge of user behaviors improved design of implementation strategies (Licker, 2005) and how knowledge about user behavior (and their readiness to accept technology) is an important part of IS-success. These studies deliver a practical focus on development, use and management of information systems but hold no direct focus on an individuated user. The position assumes that planned design can change work-place behaviors.

The emerging view

An alternative to Methodological Individualism is a more holistic view of how the socio-technical system emerges from the interplay between institutions, its structures, use of technology and processes (Lee, 2010; Luna-Reyes et al, 2004). In IS research this position translates into a view that specifically assumes that the system constitutes the setting for the individual and that socio-technical structures drive individual behavior. In particular, the institutional view highlights how institutions, processes and cultural frameworks shape the design and use of technical systems. According to Orlikowski & Barley (2001), this view helps explain techno-social phenomena that pervades life in organizations. IS-theories must "embrace the importance of simultaneously understanding the role of human agency as embedded in institutional contexts as well as the constraints and affordances of technologies as material systems" (Orlikowski & Barley, 2001, p. 158). Institutional theory reflects the position of a dual nature of technology (Lee, 2010). Adaptive Structuration Theory (AST) is a well-known theory in this line of research. AST examines and explains the interplay between advanced technologies, social structures and human action. Social structures are seen as the distinctive, stable arrangement whereby humans interact and live together (Orlikowski & Barley, 2001). While technology is not deterministic to human action, it does afford and constrain certain behaviors (Orlikowski & Barley, 2001; Grgecic et al. 2015). Grgecic et al. (2015) expand the theory of AST with knowledge about perception. Social structures affect the action of users and their perception of affordances and symbolic expressions inherent in the technologies. These influence the relation between technical objects and users. In this line of research, we find the position that technology has spirit (DeSanctis & Poole, 1998). Grgecic et al (2015) point out that users must understand this spirit, perhaps by explicitly acknowledging the functional affordances. Functional affordances comprise the possibilities for action offered by a technical object and, therefore, determine the potential use of a technical object (Grgecic et al, 2015). The same technical object can support multiple affordances because affordances do not exist without the users' intentions and their context. Depending on these perceptions, users assess the usefulness of a functional affordance.

The unifying view

IS-research is often criticized for being either too techno-deterministic or too socio-deterministic. To compensate for such contradictory critiques, Beynon-Davies (2010) proposes a unifying socio-technical framework, based on how signs are enacted by individuals. We categorize this as the third view. We identify a basic assumption about how the individual constitutes the setting for the system and how socio-technical patterns drive individual behavior. In this view neither the technology, nor the social-setting is privileged. The socio-technical system consists of a three-layer model of interacting systems. The bottom layer is the data system including technological patterns of formative acts. The middle layer is the information system including patterns of informative acts. The top layer is the activity system including social patterns of performative acts. This three-layer view of interacting systems contrasts with the either/or dichotomy that demands superiority is given to either the activity system or the data system. For example, in the design view with its focus on work-system theory (Alter, 2015) or the emerging view, with focus on the duality of technology (Orlikowski & Barley, 2001). Bélanger et al. (2014) promotes multi-level analysis to improve the understanding of the very core of IS namely IT entities, people and their interactions. Lee (2010) promotes system theory and states: "Actually using systems concepts, among other things, could play a major part in contributing to [….] the IS discipline […]. Ultimately, the IS discipline needs to employ systems concepts to a greater extent than it already has" (Lee, 2010, p. 345).

The Inertia View

We have identified a fourth view of the individual related to the socio-technical system. In this view, the system constitutes the setting for the individual and socio-technical patterns drive individual behavior. Besson & Rowe (2012) find that it is very difficult to transform structures and patterns in a system. "One must keep in mind the central paradox of organizing. Organizing means routinizing. […] this action of routinization creates inertia by entrenching the organization and causing patterns to become rigid" (Besson & Rowe, 2012, pp 105). We highlight two forms of inertia relevant to how the individual relates to the socio-technical system: (1) Socio-cognitive inertia that comes from norms and values at the individual, group, organization, industry and society levels. In this form of inertia, agents are embedded in institutions characterized by *stickiness*, the recurring re-enactment of norms and values. (2) Socio-technical inertia that comes from technological and socio-technical path dependencies. In this form

of inertia, agents are embedded in socio-technical systems that have their own dynamics, especially due to development time and internal consistency (Besson & Rowe, 2012).

Implications - need for a new view

Individualization is human behavior based on the freedom to choose and response to change in personal ways. It diminishes the effects from the system/structure (Castells, 2010; Baumann, 2011). One major drawback of the four views is that they do not directly address the individualized individual. So far, the views reveal how individuals (as a collective construct) are under the influence of institutionalization, socialization, routinization and structuration processes. But, they seem unable to explain events of individualized behaviors and how they relate to the socio-technical system. From a few articles in our search, we detected events that could be the cause of individualization, while not directly addressed as such. These events were typically described as future research areas. They include paying more attention to the entrance of new technologies (such as standard applications and platforms) that are used in a multiplicity of ways, including *unintended* ways (Söllner et al, 2016; Grgecic et al, 2015). Likewise, the influence of commoditization means that organizations and individuals (Baskerville, 2011) are more open and have easier access to new technology from outside the organization (Whelan. Conboy, Crowston, Morgan, & Rossi, 2014). Another effect is the dissolving boundary of the organization (Whelan et al., 2014) caused by connectivity-technologies that loosen organizational structures (Hirschheim & Klein, 2012). Meanwhile the individual has become more mobile and more connected. Work is less often done in the formal work-place (Hirschheim & Klein, 2012). Seen from the individual perspective of every-day life, individuals design their own complex and connected information systems to fit their own needs and behaviors (Baskerville, 2011). These individual approaches have the potential to affect the socio-technical system (Licker, 2004). Likewise, Internet technologies are predicted to affect the number and diversity of mobilizable stake-holders, thereby causing new operating models and new organizational structures for value creation and sharing (Besson & Rowe, 2012). These events point to a need for tuning our view towards the individualized individual as opposed to the socialized individual. We seek to fill a gap of explaining how the individualized individual is situated and affect the socio-technical system perspective. We set out to *re-explore* the socio-technical reality in the contemporary organization. We will accomplish this through analysis of events seen as socio-technical outcomes. Specifically we will focus on the actualized relationship between individualized individuals and the concomitant new technology affordances.

RESEARCH METHODOLOGY

We seek to explain the mechanisms that create certain events and outcomes in the socio-technical setting. In critical realist methodology, a *mechanism* is a causal structure that can trigger events (Bhaskar, 2008). Thus, a critical realist methodology provides an avenue for exploring the events around the individuation of individuals. However, at a more detailed methodological level, an understanding of mechanisms is a bigger challenge. Mechanisms are unobservable (Bhaskar, 2008). The challenge is to provide a theoretical description of mechanisms that can explain the observed events (Bygstad, Munkvold & Volkoff, 2016, 2016). "*Mechanisms* are a snapshot of those processes in the system in question that are peculiar to its kind. In turn, a process is a sequence of states; if preferred, it is a string of events" (Bunge, 2004, p.189). We will study a string of events by looking at how new technological affordances in UCC materialize as behaviors (the observable layer) that can be traced back to a mechanism (the unobservable layer). By adopting an affordance view, we conceptualize a socio-technical mechanism as a relationship between a knowledgeable human and a technological artefact. We describe this relationship "as a meeting between a need and a capability, which allows for analysis at various levels" (Bygstad et al., 2016, p. 188). The affordance approach is important since there is no method or logic for conjuring mechanisms (Volkoff & Strong, 2013). Affordances offers an analytical bridge between the observed events and the causal structure of mechanisms. It helps us to identify important constructs: 1) the socio-technical dynamics of mechanisms, and 2) the possible interaction between human/social entities and technology (Bygstad et al., 2016). For the purposes of the remainder of this study, we regard an affordance as "*the potential for behaviors associated by achieving an immediate concrete outcome* [observed from the empirical, as an event] *arising from the relations between an object* [the IT-artefact: UCC] *and a goal oriented actor* [the individuated individual]" (Volkoff & Strong, 2013, p. 823). We follow the stepwise framework for critical realist data analysis from Bygstad et al. (2016). See table 2.

Table 2. Stepwise analysis framework

Step 1	Entails description of events
Step 2	The identification of entities
Step 3	Theoretical re-description (abduction)
Step 4	Retroduction. Identification of candidate affordances through four sub-steps: a) Identification of concrete outcomes b) Analysis of the interplay of human and technical entities c) Identification of candidate affordances d) Identification of stimulating and releasing conditions.
Step 5	Analysis of the set of affordances and associated mechanisms
Step 6	Assessment of explanatory powers

Because our research question involves exploring a range of affordances and related mechanisms, we used an exploratory case study (Yin, 2004) to pursue the steps in the framework. We study *the entrance of technologies with the spirit of mobility and connectivity (UCC)* as the general event (step 1) and identify the *individuated user of UCC in the socio-technical setting of a global enterprise* as the entities (step 2). Our empirical material consists of interviews with individual knowledge professionals in 18 different global enterprises. Enterprise age ranging from 102 years and 17 years old. Sizes ranging from 49 – 244.400 employees. The respondents were selected through an open call on LinkedIn. We strove for a balance of gender and age. See table 3. In this design, we took inspiration from a study of knowledge professionals from different positions, firms and industries (Mazmanian et al., 2013).

Table 3. Respondents

M/F No.	Age	Industry	Educational level	Position
M1	53	Software & Architecture	Master	Manager
M2	49	Business IT Consultant	Master	Project Manager
M3	45	Construction Material	Master	Project Manager
M4	43	Hands-free Technology	Master	Project Manager
M5	29	Automation Consultant	Master	Project Manager
M6	46	Foreign Ministry DK	Master	Manager
M7	29	Internal Con Telecom	Master	Project Manager
F8	46	Marketing Medico	Master	Manager
F9	32	Pharma	Master	Project Manager
F10	45	Outsourcing/Consulting	Bachelor	Project Manager
F11	28	Accounting Service	Master	Project Manager
F12	47	Energy	Bachelor	Project manager
F13	42	IT-Outsourcing	Bachelor	Project Manager
F14	47	Pharma	Master	Manager
M15	35	Legal Telecom	Master	Manager
M16	43	Food	Bachelor	Manager
M17	29	Consultant Accounting	Master	Project Manager
M18	47	Mobile Technology	Master	Manager

We carried out the study in context (Yin, 2004) as online video skype meetings. We followed a simple interview guide with eight open-ended questions intended to reveal outcomes and events experienced in relation to the 21st century workplace. We remained open to other issues. The interviews took place in the period of October and December 2016. We continued to interview until we sensed that no new data could contribute with new understanding. Ultimately, we conducted 18 interviews of 45-60 minutes. We followed a semi-structured interview guide with 8 open-ended questions. Every interview began by a general question about work. Then we probed into UCC-behavior. We followed this line of questioning: What do you do? How do you use UCC and in what situations? For what purpose? How do you stay productive? Do you have specific routines? Are they specific to you or are they enforced by culture? In your opinion, has your work changed? How/why? We recorded and transcribed the interviews. The

empirical material was then subject to a qualitative analysis through a coding procedure realized using Nvivo software. Using techniques from grounded theory (Strauss & Corbin, 1997) we conducted an iterative textual analysis to understand the everyday use of UCC. We cycled through the transcripts and applied 30 open-codes and sub-codes; after several rounds, no new codes emerged. We created a graphical hierarchy map and used the memo technique for commenting and writing up themes. We eventually arrived at 8 themes. They were: significant structures in the workplace; orientation towards using I, we or them, when describing behaviors; preference for talking or texting with colleagues; the extent of virtual and physical work and preferences there-off; the maturity of technological support; the extent to which practices were individual or shared; knowledge sharing habits and lastly, issues with pace, time and speed of work. We then discussed these themes and produced memos about the associated dynamics and tensions that we saw in the data. We then identified key analytic categories, related to the research question in focus.

FINDINGS

Step 3 involves an abstract generalization of the nature of phenomenon under study. It goes like this: The core tension we saw in the data was a constant focus on how to stay productive (empowered by new technologies) and how to add value to the organization as a knowledgeable individual. We identified a need to be productive. When combined with the range of affordances in UCC, this need was met with individualized ways of working. Granted (almost full) autonomy to reach targets, these ways of working enabled the individual to take control of a wide array of work-related elements. A significant finding is that people consciously select and plan when, how and with whom to interact. Another significant finding is that people decide when to tap into the organizational information flow and when to tap into social relations at the office. Such taps must make sense and add value in relation to individual productivity.

Step 4 is retroduction. It is way of suggesting mechanisms, which are capable of causing events. *Retroduction* involves identification of candidate affordances. The several sub-steps in step 4 (see table 2) are iterative. After several iterations, it became clear that there were two levels of socio-technical affordances: An upper level affordance, in which UCC as a new technology affords the outcome of Individual Productivity, see figure 1. In a more granular analysis, the upper-level affordance stems from lower-level affordances (the specific socio-technical affordances in figure 1) with specific outcomes that combine into individualized ways of working.

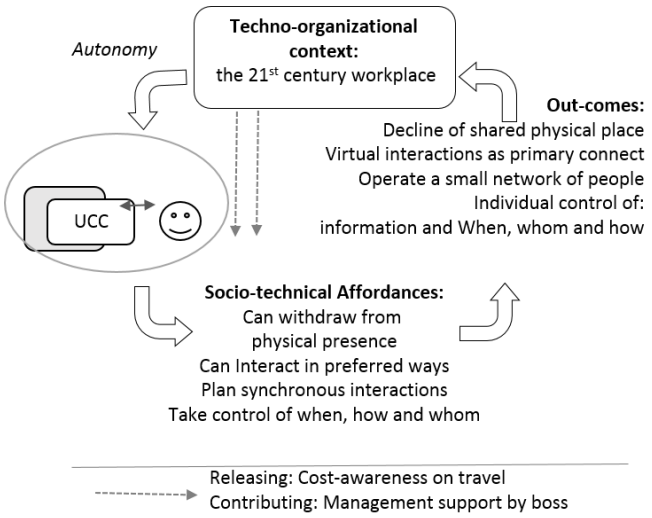

Figure 1. The individual productivity affordance

The individual productivity affordance

Step 5 involves the analysis of the set of affordances and associated mechanisms. We begin with the affordances. Figure 1 represents the complete conceptualization of the affordance structure observed in our exploratory case study in the context of the 21st century workplace.

The enabling condition is socio-technical autonomy. This autonomy influences the relationship between UCC and the individualized user. The relationship is actualized as socio-technical affordances that are related to the goal-oriented actor. The actualization is stimulated and released by certain conditions. Combined, the entities in the affordance structure produce a range of immediate outcomes. These outcomes can be observed as: (1) the decline of a shared physical place, (2) virtual interactions as primary means of connection, (3) operate a small network of professional colleagues, (4) individual control of information, and (5) individual control of when, how, whom. These outcomes and affordances in UCC show how people relate to one another in the 21st century workplace. Relations become more instrumental and more selective: they must add-value, and interactions must be productive. Thus, we observe that people relate to a few in a network-like setting, that they operate. Table 4 -9 is a detailed description of outcomes. Table 10 presents the releasing and stimulating conditions.

Table 4. Outcome

Decline of a shared physical place
"I call a lot, because I don't work with any one in my physical distance […] I'm not in the office, it is ineffective, it is noisy, no opportunity for contemplation" (F10). "I work everywhere else, than in the office (M3). "I never work from the office, if I did, I would sit isolated in one of the small quiet rooms and hold virtual meetings with my global colleagues anyway"(F9). "I work in a big open office, and I rarely work with any of them – I don't use energy on them, why should I. So some-times […] I have to be quite cold and ask my-self, do I get anything out of this? No […] I will rather use my time on something else" (F13).
UCC affords a possibility to withdraw from physical presence and social activities. UCC affords working from anywhere, connecting specifically with people that are relevant to one's work and to cut out the things deemed as not adding value in getting the work done.

Table 5. Outcome

Virtual interactions as primary connect
"My daily interactions is based on UCC, it is over skype, it is video meetings, because most resources are spread all over the region. Daily questions, check-ups, debriefings through skype (M2). "Everything I do, I do virtual, support is also virtual […] connected with voice […] we are a global enterprise, all the skills I draw on are outside of physical reach" (F10). "What connects me to the organization are the arranged meetings"[…] anytime, any device, anywhere […] it gives great freedom, to work like this" (M3). "I'm much more effective with virtual meetings […] we never use video though" (F9).
UCC affords daily interactions in preferred ways. They are carried out from various devices; It can be one-to-one, one-to-many or many-to-many; and be with or without video.

Table 6. Outcome

Operate a small network of people
"You need to take out a sample of people in the big organization. I'm really close with a few, and then there are a lot of just "Hi" because I don't know who they are […]. I use a lot of time in tending to my network" (F13). "I work in a small team of 5 people - we are a little bobble in a very large organization. We are a team, we are our own employers, I see us as an exo-organization (exponential organization) within a big organization" (M5). "I use snapchat with my network of colleagues (chefs), we send each-other pictures of food and inspire each-other on the go […] this is very value-adding" (M16). "I have a network that I tend to, that is super important" (M3). "If I reach out to the wisest and smartest, then they pull me in the right direction. I learn from them. Then I grow my market value" (M1).
The goal-oriented actor tends to a tight network of a few professional colleagues afforded by UCC to reach out and connect.

Table 7. Outcome

Individual control

"It is entirely my interpretation, there are no guidelines for use, it is the wild west […] It decreases the productivity, that we don't have better social norms" (M2). "There are no corporate policy; we have those systems to do our jobs. We adopt it in our own ways, and set it up our selves" (F14).
UCC affords individualized behaviors. People have different preferences and different ways of interacting.

Table 8. Outcome

In complete control of information-flow
"In the old days, when somebody contacted me, I felt a need to answer, out of respect, but my relation to communication has changed. The old pressure of communication meant that being present was important. It is not important any more. I choose. I open when I want, I close when I want. As a default I'm closed. That is why planning of calls/virtual meetings are so important" (M18). "If a new channel has to enter, then another must go […] if there is less value in the new, than in the old, then it doesn't happen […]. The channel who fits best in the set of channels I have, I select, and all the ones outside are simply ignored" (M1). "Many more channels have entered knowledge work - that can interrupt. It demands of me to choose where to be and where to engage. It affects my day […]. You can use to much time acquiring knowledge […]. That is the big dilemma in knowledge work today?! […]. To be very active about what to use, what not to use, and when should you use it (M7) "I'm very selective in the calls I take, at night". (F10).
UCC allows complete autonomy over the information one collects and possesses. One can manage overloads and make pertinence decisions.

Table 9. Outcome

Individual control of when, whom and how
"I work primarily virtual/IT-enabled. Most of my day is planned video meetings, only 10 % are hop-meetings" (M2). "I use 20% of my time in planning actual interaction […] there is this asynchronous move in how we live and work […] working virtual like I do, takes a lot of planning […] spontaneous calls don't work, people don't answer, so in order to get the ship sailing, you need to know when you have a 1:1 with people" (M18). "I plan meetings wall to wall, no b*reaks, I don't have to use the time to walk into another meeting room, like that I'm much more productive" (F9).*
UCC affords the possibility of "synchronous" interactions. This temporality is preferred. Synchronous conversations are effective, but it takes a lot of planning.

Table 10. Condition

Stimulating
For example, a travel policy anchored to cost-awareness is a stimulating condition: *"Meeting physical all the time wouldn't be possible, it is too expensive, so the virtual possibilities are a must" (F14). "We have a travel policy: we only fly if we have wall-to-wall meetings a whole day […] I'm very aware of the costs, so I prefer virtual meetings […] I don't get why people wants to meet physical […] it doesn't do anything for me" (M15).*
Releasing
Management support - from the boss – is an example of a releasing condition: *"The senior-partner is our umbrella"(M5) "I have a super boss, she lets me work like this way" (F8). "I have a call with my boss twice a week (M3). "My boss works from Oslo, we skype a lot" (M15). "My boss calls me every morning, to get a heads-up" (F9).*

Identifying mechanisms

Thus far, we have identified the socio-technical affordance of individual productivity in a two-level conceptual model (figure 1). We have also explained how the socio-technical affordances relate to one another (in table 4-10). Continuing with Step 5, we expand our analysis of the set of affordances to include the associated mechanisms. The individualized user is afforded new possibilities for individual productivity: the upper-level socio-technical affordance from UCC. Through UCC, the goal-oriented actor is afforded control of flow, time, place and pace of interactions and information and when and how to socialize. The goal-oriented actor takes individual responsibility of productivity and cuts down on anything not seen as value-adding. Simultaneously, this actor is creating new routines that *are* seen as value-adding. These routines are highly individualized. The organization seems to lose power in this

setting, no longer the socializing, institutionalizing and routinizing socio-technical system it was once. We observe that the individualized user turns towards a much smaller network of professional relationships.

We propose that individualization is the mechanism underlying this affordance structure. It is a candidate explanation that could explain the events and outcomes in our case. A mechanism must have explanatory powers (step 6). Figure 2 is a conceptualization of the mechanism, a string of events that can explain a mechanism (Bunge, 2004). From individualization, there is a string of events that proceeds as the causal mechanism underlying the affordance structure. New technologies, with the spirit of connectivity and mobility (recently introduced), provide flexibility. The goal-oriented actor seeks productivity (the core-tension found in the data). Exerting autonomy, the actor takes responsibility for this tension. The actor (now) controls a wide array of work-related elements (space, place, time and information flow) that have been afforded by the possibilities in UCC. Consequently, the actor relates to colleagues in an instrumental way, in a network-like structure of a few professional relationships. This network serves as a complementary structure that supports productivity. Consequently, the influence from the organizational system diminishes.

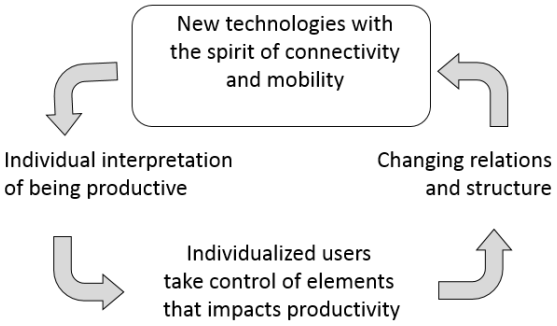

Figure 2. New mechanism at work

The proposed mechanism is one out of many mechanisms in the current workplace. It is the most likely explanation of the events proceeding from new technologies (UCC) and their affordances for individualization. Our exploratory case-study focused on the individualized user and this user's actualized relation with UCC. This relation arose as affordances and concrete outcomes of individual productivity in a socio-technical system.

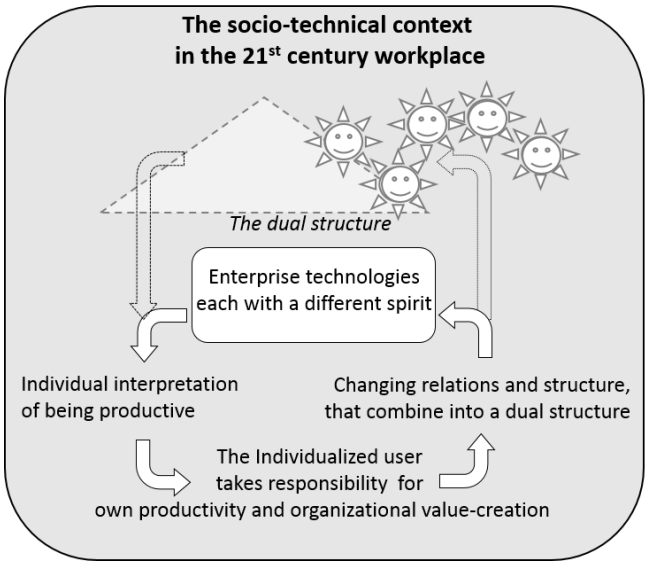

Figure 3. The individualization and socialization mechanism

The organizational reality is that technologies, each with its own spirit, are present in the socio-technical context of 21st century workplace. Thus, we propose an upper-level candidate mechanism: the autogenic mechanism of *socialization and individualization* (Hofkirchner, 2014). Autogenic mechanisms present us with a duality view in which X and Y are simultaneously and fundamentally interdependent, contradictory and mutually enabling (Farjoun, 2010). We theorize that this mechanism gives a more realistic explanation of the dynamic relationship between technologies and humans in the current workplace. Figure 3 explains this mechanism, in which a number of events arise from enterprise technologies (ERP, KM, CSCW and UCC). Many of these events can be explained by the mechanism of socialization (organizational value-creation). But the individualization mechanism explains why users enact different individualized productivity affordances from the same technology (Grgecic et al, 2015), traditionally explained as non-equilibrium in the socio-technical system (Licker, 2005).

This new candidate autogenic mechanism displays divergence and convergence in one. According to Hofkirchner (2014, 2015) it is along this line that evolution makes progress: the higher the differentiation, the higher the integration (observed as mutual enabling dual structures in figure 3). This dialectic provides a complex social system perspective of the dynamic forces that embody self-organization in a socio-technical system.

DISCUSSION

In general, we use mechanisms to explain phenomena. A mechanism denotes causality in a direct and material sense; mechanisms make things happen in the material world (Bygstad et al, 2016). In our study, we see the dialectic nature of mechanisms in the socio-technical system. By describing the dialectic that emerges between mechanisms in the socio-technical realm, we elaborate previous research dealing with mechanisms in the work-place (Lee, 2010; Baumann, 2011; Volkoff & Strong, 2013; Bygstad et al, 2016).

Identifying the socio-technical mechanisms at work in relation to individualization in society is important to understand. We extend existing individualization work by explaining similar effects on organizational use of IS. In this way, the string of events described in our research extends the behavior and effects of individualization described in previous research (Castells, 2010; Baumann, 2011; Mazmanian et al, 2013).

A predominant understanding from our literature review was that technology has institutionalizing, socializing and routinizing effects in their interaction with humans in the organizational context. Our literature review offers an original contribution by identifying and analyzing four different views that are currently present in the literature. This analysis suggests that their collective understanding no longer gives a full account of the socio-technical dynamics in the current workplace.

The rich palette of enterprise technology affords productive and effective ways of working in the organization. We identified affordances in UCC, caused by the socio-technical mechanism of individualization. UCC with the spirit of mobility and connectivity affords new relations that eventually create a parallel structure.

We propose a view of an upper level mechanism that gives a new perspective in which individualization and socialization interactively drive the interplay between technology and humans. This perspective reveals how individual relations in the workplace undergo change differently afforded by technology. It relates the spirit of a technology with the socio-technical and individualized affordances realized by a goal-oriented actor. Such a revelation means that current explanations of work-practices will now prove incomplete without accounting for individualization. We also elaborate the notion of individualization as related to socialization as described in Hofkirchner (2014, 2015) as a candidate mechanism explaining the socio-technical reality in organizations.

In this way, the present study contributes by extending the literature regarding the individuated individual in the socio-technical system (See table 1) by showing that individualization is now playing an equally important role as socialization in the socio-technical system in the 21st century enterprise. This duality has not been studied from a socio-technical system perspective previously. Our study presents a new way of understanding the individualized individual in the socio-technical system.

This work is significant to anyone engaged in explaining work-practices as a subset of human behavior in the workplace. It can be especially important to managers and practitioners charged with supervising or engaging with individuated individuals operating in the organizational workplace. It helps explain the nature and the value of workplace behavior that might otherwise be mistaken as counter-productive. This understanding can help managers properly capitalize on their investment in affordances that bring individualization.

As an exploratory case study, this research is limited to a qualitative, interpretive view of socio-technical phenomena. This view enabled the discovery of the mechanisms, affordances, and individuation effects of technologies with the spirit of mobility and connectivity, as described above. Future longitudinal research is needed to test whether

these effects are present in other cases, taking the full set of enterprise technologies into account. Such research can determine whether knowledge of these effects has practical value in other 21st century organizations. Future research should also look into any negative side-effects of individualization, especially in relation to socialization. According to Hofkirchner (2015) individualization can lead to individualism and egoism. Likewise, socialization can lead to rigid system regimes. In both instances, the system may decline and break down. Future research should consider the risk in disrupting the dialectic nature of the upper-level mechanism suggested earlier: that afforded by introduction of new technologies with a different spirit in the IS.

CONCLUSION

Work is no longer done only in the social-setting of *one* organizational structure and system. New technology affords new ways of working. These new ways of working include those that are afforded by extensive technological support of individualization. This individualization enables people to interact and socialize in new ways, using a network of a few professional associates. Consequently, work is now being done in dual structures: the individual-with-network and the organization. This is important because it reframes the way we explain and manage technology and behavior in the workplace. Our study suggests a different interplay between technology, people and the social-structure in the 21st century enterprise.

The dialectic nature of socio-technical mechanisms of socialization and individualization calls for a re-thinking of how we adapt socio-technical system theory in the light of complex social systems. We suggest future work into a socio-technical perspective will help us understand the introduction of individual technologies and the new socio-technical reality of organizations.

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The Digital Individual:
Changing the Nature of Knowledge Creation

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Introduction

A related consequence of the internet's transformational effects (Castells, 2014) is that organizational hierarchy falls in favor of a flatter and more responsive, agile and networked enterprises (Rainai & Wellman, 2012; McAfee, 2009). In this digital connected world the individuated individual takes center stage (Castells 2014) and becomes the focal operator in a network enabled by cloud, mobile and social platforms (Rainai & Wellman, 2012).

Inspired by – in part - Hemsley and Mason (2013) we believe that the dominant Knowledge Management (KM) paradigms and models are "ill-suited for the knowledge environment facilitated" (Hemsley and Mason, 2013, p.139) in today's enterprises. In this paper, we *problematize* one of these paradigms – the life cycle paradigm; and the knowledge conversion model alternative between tacit to explicit knowledge in the form of socialization, externalization, combination and internalization. This model is known as the SECI-model and was introduced by Nonaka (1991) and later epitomized in the book by Nonaka & Takeuchi (1995). These works are by far the most cited works in KM. The article has been cited 11459 and the book 42932 times, as of 15 November 2017[1].

We suspect that the digital individual fundamentally make change to the knowledge-creation and learning patterns *per se* and that these changes eventually challenge the assumptions from which a prominent body of literature within the discipline of Information Systems (IS) and KM are built, from now of IS/KM. According to Newell (2015) Nonaka's thinking and associated accounts of the most effective ways to transfer different types of knowledge (explicit and tacit through repository or network KMS respectively) have been used in the IS literature (Newell, 2015).

We ask how does the digital individual change the knowledge creation cycle.

We apply the method of problematization from Alvesson & Sandberg (2011). They *"propose problematization as a methodology for identifying and challenging assumptions underlying existing literature and, based on that, formulating research questions that are likely to lead to more influential theories"* (ibid, p. 247). We follow the six consecutive questions: 1. what key texts make up the domain (seminal and new examples). 2. Identify and articulate assumptions, 3. evaluate articulated assumptions, 4. develop alternative assumptions, 5. relate assumptions to an audience and finally, 6. evaluate alternative assumptions and generate an interesting research question aimed at the audience targeted (Alvesson & Sandberg (2011). Our area-of-concern situate us in a cross-disciplinary discourse of IS/KM.

What are the key texts in the field?

Based on a long-term interest in the field we selected articles from authors and outlets which are highly acknowledged by colleagues in the community of IS/KM. The following articles constitue the main texts from the IS/KM domain, presented in this section: We refere to Hansen, Nohria and Tierny (1999); Alavi & Leidner (2001) and Lee & Choi (2003) as original examples of how the SECI-model (and the

[1] The 15th november is the date we checked Google for the number of quotes for the older references constituting key texts.

thinking system) has been adopted into the IS-dicpline. We refere to Zang, Cialdone & Ku (2001), Zang & Venkatesh (2017); Yong, Hsu, Sarker and Lee (2017) and Newell (2015) as the most recent examples bearing witness to a continued influence in the IS/KM-litterature.

The SECI-model's influence on the IS/KM theories is noticeable. Alavi & Leidner (2001) review are one of the most cited in our field, it is cited 10629 times. Herein they promote a view of KM being *as a process of applying expertise* and suggest that Knowledge Management Systems (KMS) should focus on *knowledge flows* and on a process of first creating, then sharing and finally distributing knowledge in the organization. In particular, they explain that knowledge flows builds on the SECI-model view, in which an organization is a dynamic and continuous set of knowledge conversion *processes and practices* embedded in individuals, groups and physical structures. Another well cited article in our community are from Lee, H & Choi, B (2003). They build on the SECI-model directly and talk about organizational knowledge as created through cycles of combination, internalization, socialization, and externalization that in turn transform knowledge between tacit and explicit modes (Nonaka, 1991). This article is quoted 2041 times. When applying the theoretical understanding of Nonaka's (1991) thinking system, two types of knowledge are usually defined, namely *explicit and tacit knowledge*. Many theories take root in the interaction and relationship between these two types of knowledge. The seminal article from Hansen, Nohria and Tierny (1999) builds on this difference between tacit and explicit knowledge. They developed the codification and personalization strategy pointing to an 80/20 balance either way. It has been cited 6193 times. Zang, Scialdone and Zu (2011) say the role of a KMS is a mean to provide a link among sources of knowledge (the users and repositories) to create a wider breadth and depth of knowledge flows (ibid, p. 111). This thinking most dominantly comes from the life-cycle account from Nonaka's (1991) SECI model – which essentially looks at the movement of knowledge between different states (explicit and tacit) that he argues is essential for knowledge creation (Nonaka, 1991)**.** Newell (2015) takes stock of the literature and describes that KM in relation to IS/IT often draw on the lifecycle account from Nonaka (1991), this view suggests that both codification (through a repository) and personalization (through networks) are important for different tasks necessary to complete the knowledge creation cycle. In this lies one of the basic assumptions about IS/ KM, that the IS can enhance and enable the dynamic process of knowledge creation, by drawing on technologies that support the conversion from tacit to explicit knowledge and that this dynamic process, eventually leads to organizational knowledge. A recent example of a theory development building on both Alavi & Leidner (2001) and the distinction between codified and personalized knowledge is Zhang & Venkatesh (2017). They define a *"KMS as an IT tool incorporating any combination of the following technologies—knowledge repositories, personalization-based systems, network-based systems, and interactive systems to facilitate organizational learning by capturing and disseminating knowledge"* (ibid. p. 1279). Zang & Venkatesh (2017) likewise build on Alavi & Leidner' (2001) defintion of a KMS by describing that it typically incorporates diverse features to facilitate knowledge exchange, transfer, and application. One of the latest articles are from Yang, Hsu, Sarker and Lee (2017). They focus on the knowledge creation process that facilitates the transformation of existing organizational culture into new business processes.

Identify and articulate assumptions: What major assumptions underlie the literature within the identified domain?

Having established the influence and the emergence of theories in IS/KM, based on the SECI-model it is important to revisit the major assumptions and core tenets of this thinking system. A core tenet in the theory is that knowledge is created in people and in their interactions with each other and the environment (Nonaka, 1991). Knowledge creation is a process in which individual subjective thoughts are justified trough social action and experiences with others and the environment to become justified belief. Justification of belief trough social interaction is necessary, and possible, because the meaning derived from a phenomenon varies with each individual. The core of this model is that humans have different subjective viewpoint (mindsets) differences necessary for creation of knowledge. The model

rests on the idea that humans obtain new knowledge through their individual active and subjective shaping and integration of experience, also called tacit knowing (Nonaka et al, 2008). This is sometimes referred to as know-how. Knowledge is created when we as individuals respond to a reality and position this reality within ourselves. It is in relation to this knowledge that we actively integrate our experiences and, in the process, create new knowledge and meaning (Nonaka et al, 2008). The four modes of conversion: socialization, externalization, combination and internalization has for long dominated the language of knowledge creation and organizational learning. Thus, knowledge is continuous dynamic process (Nonaka et al, 2008). The basic assumptions are thus that the SECI-model explains how individually obtained knowledge and expertise turns into organizational knowledge trough conversion; that tacit knowledge is based on extensive experience and individual reflection from the interactions with the environment. Knowledge is created when subjective thoughts are articulated in groups that refine and conceptualize the knowledge through articulation. Social interaction with diverse members from the organization is necessary in order to create knowledge that can combine with the true belief of the organization. This turns into improved forms of organizational knowledge, that through internalization, turns into know-how.

Evaluate articulated assumptions: Are the identified assumptions worthy to be challenged?

In order to evaluate these assumptions, we must look to the changes in knowledge creation as described by different authors. We began this paper, by highlighting the individuated individual in network-like settings, enabled by connectivity-technology. We suspected this could represent a transformative driver of change into the practices of knowledge creation. We now turn to literature that explains the current practices of knowledge creation in these settings. Due to page limit, we stick to a few but important contributions, on the current phenomena that we deem significant to the purpose of problematizing the assumptions from above. We started by referencing the concern from Hemsley and Mason (2013), in as much as they see that increased connectivity creates a complex and fast changing business environment (Hemsley & Mason, 2013). In this environment knowledge creation (as we know it from the SECI-model) is affected by the wisdom of crowds and many knowledge sources from outside the organization. In many situations, these sources shows more effective than relying on internal knowledge processes of applying organizational expertise. In conclusion, the rise of connectivity alters the learning processes. To better understand what this means we draw on Siemens (2005) work of learning in the digital age. Siemens (2005) describes that a new logic to learning and knowledge creation has risen in terms of altering the learning strategies of humans. One of the major changes are that learning formerly relied on experience as focal in the process of learning, but in a connected world, a new focus that centers around know-where and NOT know-how or know-that, have risen. Newell (2015) describes a change in decision making processes in this environment; from being based on a traditional view of understanding cause and effect (based on personal experience) as a basis for making discriminations that allow humans to make knowledgeable decisions, is transferred to wisdom of the crowd or patterns in data sets (big data). Know-where becomes important, and is the logical result of relying more on external sources of expertise (Hemsley and Mason, 2013). With increased connectivity, the organization responds with KM-strategies that increasingly aims at the outside world (Von Krogh, 2012). The knowledge practices in this information environment changes. Newell (2015) describes a practice of tapping into networks or reacting to a sensor as ways to explore and exploit knowledge. Employees use social software rapidly to identify and access content or people that are useful for solving a specific task (Von Krogh, 2012). Social media fundamentally disrupts the way employees deal with knowledge i.e. practices are founded on socially oriented principles that include more peer production and unbounded collaboration. These practices are enabled by easy to use and intuitive to understand applications such as blogs, wikis, platforms or media sharing (Von Krogh, 2012). The social network becomes personal, and the individual is the autonomous center (Rainei & Wellmann, 2012). Rainei and Wellmann label this *networked individualism*, and describe a new operating system in which people are interacting with diverse others: doing several things simultaneously. The lines between

information, communication and action are blurred and "networked individualist use the internet, mobile phones and social networks to get information at their fingertips and act on it, empowering their claims to expertise (whether valid or not)" (Ibid, p. 28). Razmerita et al (2016) describe strategies that embrace the personal dimension of knowledge created in networks through social media. The shift in technology as an ubiquitous enabler, helping organizations and individuals to gather information, when needed and make smart decisions faster (Razmerita et al, 2016) forms an equipped context, which produces work that is knowledgeable (Newell, 2015). The new practices alters the learning process i.e. as obtaining know-how. It is fundamentally changed. Learning is no longer the accumulation of knowledge through either reasoning or experience. Instead, personal knowledge is comprised in a network, which feeds into organizations, which in turn feed back into the network, and then continue to provide learning to the individual (Siemens, 2005). This cycle of knowledge development (personal to network to organization) allows the digital individual to remain current in his field through the network. In 2016, Razmerita et al. (2016) propose that the organizational responsibility no longer is to manage the knowledge process (as in creating, sharing and distribution of knowledge) but instead to enable users with technology that are open to appropriation and fitting to individual needs and preferences.

According to the description of the present enterprise and the changing knowledge creation process, we can now challenge the assumptions from the thinking-system from Nonaka, 1991. When we critically asses the changes and relate to a SECI-*understanding*, we see important elements in each of the conversion modes changing. *Internalizing knowledge* into know-how is supplanted by a process of tapping into personal networks of expertise, sensors and wisdom of crowds. *Externalizing knowledge* is the new important activity of conceptualizing knowledge from these personal networks to groups. *Combining knowledge* from knowledge creation at individual and groups levels then combined with organizational systemic knowledge seems to suffer in this new environment. *Socializing knowledge* from imitating others tacit knowledge is now achieved through critical reflections in interaction with human- and non-human actors, when tapping into networks of expertise and sensor-data, conceptualizing new knowledge.

Develop alternative assumptions: What alternative assumptions can be developed?

The digital individual fundamentally changes the nature of knowledge creation patterns. We see 5 new characteristics defining the digital individual's knowledge creation pattern. 1) individualized information flow and 2) Knowledge is created in and from personal networks. 3) *Know-where* is more important than *know-how* and 4) Knowledge and expertise is not build from *know-how* through experience, it comes from critical reflections and conceptualization. 5) Claims to expertise comes from wisdoms of crowds, big data and sensors, and 5) an infinite amount of knowledge is not processed into systemic knowledge on an organizational level. In this reality, the SECI-model seems ill suited for explaining the present knowledge creation pattern. A logical generalization, is that the IS/KM theories that build upon the assumptions in Nonaka's model, must also be re-considered.

This raises a number of new questions of how well suited our IS/KM theories are for explaining the 21st century workplace. We can think of new research questions in terms of: Do the digital individual change human relations in the 21st century enterprise? How are our analytical lenses fitted to the individuated individual situated in the Information System? What are the underlying mechanisms that can explain these changes in IS and how have mechanisms changed in the IS?

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SOCIO-TECHNICAL CHANGE: THE EQUILIBRIUM PARADOX

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Research paper

Abstract

In the domain of change and information systems (IS), we have persisted in the assumption that a well-functioning IS exhibits a balance between the social and the technical structures such that this system rests in a state of stable equilibrium. When transformational change arises, the system falls into a state of disequilibrium, until it reaches a new state of equilibrium. This assumption no longer gives a full explanation of the complex dynamics in today's enterprise. In this paper, we explain the concept of unstable equilibrium that results from the continuous change that individuated individuals make in socio-technical structures. Our findings arise from a critical realist perspective used to interpret data from an e-group interview with 11 professionals working in platform-based organizations. We find that a generative mechanism of contradictory complementarity, denoted as individualization and socialization, now inhabits the IS and causes outcomes that are both individual-technical and socio-technical. Now change happens in the surface-structures resting in unstable equilibrium, while the deep structures remain in stable equilibrium. This equilibrium paradox *in socio-technical change explains how platform-based organizations achieve change by both achieving agility from their IS while simultaneously achieving stability.*

Keywords: Socio-technical change, platform-based organizations, generative mechanisms, contradictory-complementarity, individualization and socialization, equilibrium paradox

1 Introduction

The periodicity narrative is a dominant metaphor of organizational change and transformation (Lewin, 1947; Tushman and Romanelli, 1985; Gersick, 1992; Smith and Lewis, 2011). A periodicity narrative assumes such change will *complete* a cycle, a series of events, or a single action. Lewin's three-stage model of unfreeze, change and freeze is one of the most well-known periodicity narratives (Lewin, 1947). Organizational change, when it relates to the use and application of technologies has a similar explanation. In IS Research, the punctuated equilibrium model serves as a periodicity narrative (Besson and Rowe, 2012). The model explains a process of change in which the IS resides in a state of equilibrium, and when transformational change happens, the system enters a state of disequilibrium, until it reaches a new state of equilibrium (Lyytinen and Newman, 2008). The state of equilibrium covers a balance between the social- and technical subsystem manifested as the organizations' deep structures. The model demonstrates that the IS rests in long states of equilibrium and short states of disequilibrium. This equilibrium is one of the core tenets in socio-technical change theory (Lyytinen and Newman, 2006) and the objective of a well-functioning IS (Besson and Rowe, 2012).

Because of recent changes in the architecture of IS (Bygstad, 2016), we suspect that this explanation no longer gives a full account of how the present IS changes and transforms. In the current organization, many continuous and transformative socio-technical changes happen concurrently (Hanseth and Lyytinen, 2010; Bygstad, 2016). Driven by miniaturization of hardware, advancements in cloud services, internet speed, and dedicated operating systems (Faisal and Leiper, 2014) new technological platforms

and apps are being brought in by both individuals and organizations to enhance information processing capabilities and coordination (Zammuto et al., 2007; Eason, 2008; Bygstad, 2016). Some of these technologies are much more mobile and malleable than their predecessors (Richter and Riemer, 2013), while others are more rigid and prescriptive (Strong and Volkoff, 2010). A consequence is paradoxical situations where managers adopt more agile approaches to enable innovation and flexibility, while simultaneously adopting standardized platforms and strict scripts for work. These paradoxes are rarely studied (Besson and Rowe, 2012).

Eason (2008) points out that the continued development of socio-technical change theories is increasingly important in an area that is getting more and more complex. We are interested in explaining the cause of outcomes in the interactive and somewhat paradoxical relationship between individual agents, social organizational structures and technology, in - what we for the remainder of this paper call – the platform-based organization.

The concept of *the platform organization* denotes a meta-concept of an influential context that molds structures and routines, shaping them into forms, such as hierarchy, flat-archy or a mix. It is characterized by serendipity and surprises, and of members that are busy improvising and tinkering (Ciborra, 1996). Our concept of a *platform-based* organisation (PBO) pertains to the fact that usage of digital platforms and applications increasingly constitute structures and routines (Zamutto et al, 2007) and thus become an influential element of the context in the present environment.

Our research question is: How do PBOs achieve socio-technical change?

We apply a critical realist (CR) perspective to explain underlying generative mechanisms causing observable events from a qualitative exploratory study (Bhaskar, 2008). In CR, a generative mechanism (GM) is a causal structure or process that comprises the essence of a concrete system (Sayer, 1992). According to Donati (2015), GMs have the power to keep changing the structural relationship between entities in a system, predominantly because GMs hold a contradictory complementary nature. Hofkirchner (2014) defines such a GM *of contradictory complementarity* in terms of the interaction between socialization and individualization. This mechanism explains change of social systems in terms of individuated individuals. By *individuated individuals*, we mean organizational members who are social actors, but act with a self-oriented autonomy less anchored in social norms (Castells, 2014; Donati, 2015). Through social relations, these individuated individuals shape the common good, i.e. shared resources that everyone has an obligation and interest in nurturing. As an example, information and knowledge are a commons (Hess and Ostrom, 2007). The causal process proceeds like this: through action and interaction, individuals form societal relations that condition the generation and utilisation of shared resources and facilities in an integrated way. This in turn allows individuals to discriminate: the more individuals are "individualized", the better they contribute to the common good; the better the common good is "socialised", the more individuals can become individuated (Hofkirchner, 2014). This is the essence of a self-organizing system. The process can eventually break down; the socialization from the system and its structures can become too rigid; individuals on the other hand, can become too egoistic.

By understanding the causal power of contradictory complementary GMs that condition the routines and structures in PBOs, we can supplement prior explanations of how to achieve socio-technical change and equilibria. Ultimately, we seek to complement the theory of socio-technical change by challenging the current explanation of punctuated equilibria. Thus, the aim of this paper is to contribute to the development and to present an explanatory model of socio-technical change in PBOs. This is important for IS-scholars developing theories of the current IS, and for designers and managers, when they plan and explain expected out-comes from their socio-technical interventions in the present world of work (Mumford, 2006).

The remainder of the paper is structured as follows: In section 2, we review related literature on socio-technical change and equilibrium. In section 3, we present the methodology, the philosophical underpinning, interpretative framing, research design and data-collection strategy. In section 4, we present the findings. In section 5, we discuss our contribution to socio-technical change theory and in section 6, we conclude.

2 Related Literature

Based on a retrospective search in the AIS-Journal Library using the search terms "socio-technical" AND "change" in titles and abstracts a narrow subset of 16 articles was selected. After an extensive reading of this literature and following a snowball citation search, the final body of knowledge amounted to 32 relevant articles. These are primarily from top-journals in the IS-field accompanied by the fields of management, organization and economics[1].

The theories of organizational change and technology primarily differentiate in how they view determinism and causation. Essentially, the differences exist around what determines change and what causes change. Markus and Robey (1988) refer to three different causes that are imperative to organizational change and technology. First, the technological imperative is one in which a new technology and its possibilities are the cause of change. Second, the organizational imperative is one in which the organization sees a need for new information processing opportunities and designs a new supporting technology. Third, the emergent imperative is one in which neither technology nor the actors are causing the change while it is the complex social interaction and usage of technology that creates unpredictable outcomes. DeSanctis and Poole (1994) have a similar division and explain three different views. The first view regards the structure of a technology as superior to humans and thus enables humans to carry out certain tasks better. Thus, the introduction of any technology is an improvement in productivity, efficiency and satisfaction of individuals and organization. The opposite view is non-deterministic. It is called the institutional view in which technology is an opportunity for change, rather than a causal structure. Studies that adhere to this view focus more on the social side of structures. Such studies are interested in how people structure their institutions and do not assume that technology determines behavior. Instead, people generate social constructions of technology using resources, interpretative schemes and norms embedded in the larger institutional context (Orlikowski, 1992). The third view is the integrative view, called social technology. In this category, we find socio-technical systems theory (Mumford, 2006; Eason, 2008) and adaptive structuration theory (DeSanctis and Poole, 1994). In this view, the focus lies in the interactive relationship between technology and humans (Orlikowski and Scott, 2008). It represents soft-determinism where adoption of technology is interpreted as a process of organizational change. Orlikowski and Scott (2008) arrive at a similar division of views, thus introducing sociomateriality as a novel view of the constituent inseparable relationship of the social and the material (technology) observed as day-to-day use of technology during practices.

The aim of this paper is to look further into the view of organizational and technological change from the perspective of integration and social technology. This view, as explained above, relies in general on a causal logic that inhabits a soft-deterministic understanding of how systems change. Soft-determinism sees events occurring in accordance with causal laws that can describe how events occur; but these laws may not predict them. Thus, the remaining part of the review is centered on two important constructs from Lewin (1947): How do the different articles view the objective of socio-technical change? What are the kinds of equilibria in socio-technical change?

2.1 What is the objective of socio-technical change?

The objective of change is, according to Lewin (1947), to raise the level of a process. In the social world of organizations, the objective of a process has humanistic and economic aspects such as productivity, efficiency and employer satisfaction. In socio-technical change theories, the objective of change varies in terms of improvements to routines, business processes, practices and structures. The change objectives in socio-technic pertains to productivity, enablement, efficiency, feasibility and humanism, etc.

[1] The retrospective search matched literature from *European Journal of Information Systems, Journal of Strategic Information Systems, MIS Quarterly, Journal of Information Technology, Information Systems Journal, Communication of the Association of Information Systems, Journal of the Association of Information Systems*. The snowball citation search led to additional outlets such as *Organization Science, Academy of Management Journal, Academy of Management Annals, Human Resource, Econometrica, Info systems Annuals, Journal of Engineering and Technology Management, Journal of Information technology Cases and Applications, Sprouts Working Papers on Information Environments, Systems and Organization, and the Society for Philosophy and Technology*.

The theories share a common aspiration to explain change as a socio-technical arrangement that ensures an optimal balance between the technology's institutional purpose and the social system's adaptation to new ways of working. When the object of change is new routines, the literature highlights aspects of repetitiveness, invariance and regularities (Baskerville, Travis and Truex, 1992; Robey, Anderson and Raymond, 2013; Swanson 2017). However, when the object of change is new business processes, aspects of stability and integration is mentioned (Bostrom and Heinen, 1977; Bygstad, Nielsen and Munkvold, 2010; Niederman and March, 2014). Likewise, new practices inhabits emergence and usage patterns (Luna-Reyes et al, 2005; Orlikowski and Scott, 2008; Hovorka and Germonperez, 2013; Cecez-Kecmanovic, Kauts and Abrahall, 2014). Finally, when the change involves new structures, the role of technology as enabling deeper levels of structures is focal (Wand and Weber, 1995; Truex, Baskerville and Klein, 1998; Lyytinen and Newman, 2006; 2008; Silver and Markus, 2008; McLeod and Doolin, 2012). While new structures also come from the relatively stable relationship and mutual adaptation between structures and actors, jointly determining the usage-outcome (Orlikowski; 1992), DeSanctis and Poole, 1994; Griffith and Dougherty, 2002; Licker, 2004).

The predominant framing of objectives denotes stability - in terms of aspects such as repetitiveness, routinizing, regularities, emergent patterns and mutual adjustment. Closely related to stability, in the socio-technical perspective, is the balanced integration between the social and the technical sub-systems in the IS.

2.2 Kinds of equilibria in socio-technic

Balance is a key underpinning of socio-technical philosophy (Ropohl, 1999). Balance is where *"the social components of an organization are combined with the technical components in an attempt to create a balanced and synergistic relationship"* (Griffith and Dougherty, 2002, p. 219). The term 'equilibrium' derives from Latin. "Acqui" means equal and "libra" refers to balance. We use the term to denote different kinds of equilibria in any system perspective from social, organization, IS and economic theory. The specific theories dealing with equilibrium and socio-technical change have specific underlying assumptions of equilibrium. These assumptions draw on different framings of equilibrium - from quasi-stable equilibrium, punctuated equilibrium to non-equilibrium.

In economics, the term *stable equilibrium* refers to a situation in which the equilibrium dislocates because of insignificant change. However, activated mechanisms restore the equilibrium back to its original balance (J.R. Hicks in Metzler, 1945). Lewin (1947) uses the term of *quasi-stationary equilibrium*. The word *quasi* means that a system is seemingly in full balance, but living systems have a balance that flows forward like a river, with a certain direction and a certain pace (Lewin, 1947). Swanson (2017) and Lee (2010) see the system as slowly evolving over time. Swanson (2017) interlocks with organizational theory suggesting that relatively invariant routines guide behaviours. While Lee (2010) explains the continuing and reciprocal adjustment between the organizational system and the technological system. Niederman and March (2014); Cecez-Kecmanovic, Kauts and Abrahall (2014); Hovorka and Germonperez (2013); McLeod and Doolin (2012); Bygstad, Nielsen and Munkvold (2010); Silver and Markus (2008) and Baskerville, Travis and Truex (1992) seem to mirror the perspective of quasi-stable equilibrium, though not using the term balance or equilibrium.

In economics, a *neutral equilibrium* describes the situation in which an equilibrium is displaced and forces are set in motion that settle the system in a new state of equilibrium away from its original position (J.R. Hicks in Metzler, 1945). In social theory, the theory of *punctuated equilibrium* describes this situation. The theory explains changes in complex social systems (Gersick, 1992), suggesting that most social systems exist in an extended period of convergence (resting on equilibrium). This state is punctuated by sudden shifts of radical change in which the social system enters a state of non-equilibrium (Tushman and Romanelli, 1985). Lyytinen and Newman (2008) refer to long periods of equilibrium in which a socio-technical system balances due to its deep structures. For Lyytinen and Newman (2008), a punctuated equilibrium rests on four important notions: 1) Socio-technical systems have deep structures 2), these deep structures give them long periods of stability 3) then something radical happens that makes the system unstable, 4) such a punctuated equilibrium can happen at any level. Wand and Weber

(1995) describe the deep structure of an IS as comprising those properties that manifest the meaning of the real-world system. It is this real-world system that the IS is intended to model. Deep structures are highly stable for two reasons: *"1) The trail of choices made by a system rules many options out, at the same time as it rules mutually contingent options. 2) The activity patterns of a system's deep structure reinforce the system through mutual feedback loops."* (Gersick, 1992, p. 17). Users interact with these deep structures through what Truex, Baskerville and Klein (1998) denote as a s*urface structure,* a phenomenon encompassing the facilities that are made available in the IS allowing the users to interact with the system. These surface structures depend on the *deep structure scripts* that provide a representation of the system (Wand and Weber, 1995). Orlikowski (1992); DeSanctis and Poole (1994); Luna-Reyes et al, (2005) and Robey, Anderson and Raymond (2013) seem to reflect changes that occur as punctuated states of equilibrium, though not using the term.

The third framing of equilibrium is non-equilibrium. Licker (2004) suggests that an IS is never in balance. Actually, it is inherently unstable, always lacking balance. These systems cannot be known, controlled or predicted like those in a state of equilibrium, they are always in a critical state, where small things affect in unpredicted ways (Licker, 2004). In economics, the framing of non-equilibrium is unstable equilibrium. An *unstable equilibrium* describes a fragile state of equilibrium in which, when disturbed, the system tends to move further and further away from its original position due to self-enforcing mechanisms (Hicks in Metzler, 1945).

In summary, the assumptions underlying the body of literature are that systems rest in quasi-equilibrium *either* as a continuous state or punctuated in terms of a short period of dis-equilibrium. Only one paper (Licker, 2005) mentions non-equilibrium.

2.3 What are the difficulties with these explanations?

We have focused on articles that belong to the social technology view with change objectives such as practices, routines, business processes and structures. The theories predominantly inhabit a soft-deterministic assumption and a linear logic. The main objective of a socio-technical change is quasi-stability based on deeper structures. This stability influences the surface structures made available through the deep structures. As such, it is assumed that socio-technical systems exists in long periods of quasi-equilibrium that can turn into disequilibrium, thus shifting episodically between the states while always settling in a new quasi-stable equilibrium.

Much of the research associates change and punctuated equilibrium with deep structures. There is much less research that considers surface structures as a component of change and punctuated equilibrium. Instead, some research has suggested that the dyadic between deep and surface structures overlooks other kinds of structures. For example, Strong and Volkoff (2010) suggested that there is a third world of structures; latent structures (such as culture and organizational translations) that proceed from the changes in surface and deep structures. In PBOs, the necessary organizational features that enable agility must necessarily be embedded in changes to surface structures.

Much of the research on equilibrium refers to long periods of quasi-stable equilibrium. There is much less research that considers unstable equilibria as a component of change, in which a system moves further and further away from its original position due to self-enforcing mechanisms (J.R. Hicks, in Merckel 1947).

As mentioned in the introduction, we question whether the theories *per se* acknowledge the complexity of change in PBOs. We view the PBO as inhabiting an influential digital context consisting of deep and surface structures. As a consequence of individual improvisation, PBOs reshape into new forms of organizing. This serves as a good setting for further scrutiny of socio-technical change. Donati's (2015) view on GMs as contradictory complementary can act as an unlocking device, explaining the impact from the individuated individuals who act with less and less influence from the system (Castells, 2014; Benkler, 2006). Instead, they increasingly act on the fads (Donati, 2015) presented to them at the surface level. Castells (2014) explains this as the process of *individuation,* as the construction of autonomy by social actors who become subjects in a process of defining their specific projects in interaction with, but not submission to, the institutions.

Based on our literature review, we suggest that socio-technical change theory must now extend to new issues such as generativity and the influences of different structures. These new issues both challenge and renew the assumptions about quasi-stable equilibria and punctuated equilibria. This extension is important if a socio-technical change theory it is to make sense in PBOs.

3 Research Methodology

In this section, we describe how we approach this exploratory research from the philosophical perspective of critical realism (CR). We then explain the interpretative framing. Finally, we proceed to research design and data-collection strategy.

3.1 Philosophical underpinning

By applying a critical realist understanding of the world, we can explain mechanisms, their properties and interplay between constituent levels of reality that depend on external as well as internal relationality. CR according to Roy Bhaskar (2008) separates reality in two dimensions. The transitive dimension consists of theories, technologies and social practices. The intransitive dimension is the opposite: an external reality that exists independently of human consciousness, which consists of structures and mechanisms of the natural world (Bhaskar, 2008). In CR, the underlying structures and mechanisms enable and cause the phenomenon that appears before us in the transitive dimension. A core tenet in CR is to understand social reality as an open layered system of objects with causal powers. It divides social reality into an actor- and structure level. Structures are important for the social actor, but do not constitute the actor. It gives certain possibilities and constraints, while leaving something for the actor herself (Bhaskar, 2008). We employ Donati's conceptualization of non-mechanical GMs as causal processes that entails the dynamics of a social structure, with first- and second order feedback (Donati, 2015). First-order feedback can be positive and negative on individual actions and second order feedback can be positive and negative on social relations. An example is the relational process of *individualization and socialization* explained in the introduction. For the remainder of this paper we adopt the concept of GMs that exhibits this internal relational configuration. At the empirical level, a GM shows properties such as resilience, elasticity, instability and an interplay between the levels of reality that depend on their external relationality. The (re)forming of structures and routines in PBO's is an example of the interplay of individual actions and social relations. The relational logic is a combinatory logic that is different from linear logic that inhabits prior theories. The logic is based upon interaction and contradictory complementarity between two opposite realities and the acceptance of the paradox, without conflating them. The relationship between the two opposites consists simultaneously of a related exclusion and inclusion. As an example, individualization and socializations happen simultaneously. They are not oppositional/conflicting, however enabling each other. According to Donati (2015), GMs enter and influence the system, observable through downward causation. We look for GMs with contradictory complementarity that exert *downward causation* in the PBO. Downward causation is closely related to the concept of supervenience and is used in studies of complex systems that exhibit a kind of self-organization and emergence of visible structures when the systems are far from equilibrium conditions. Occurrences at the micro-level can directly influence occurrences at macro-level. This influence means that we cannot really understand social relations without knowing something about individual actions. In our study, we separate the empirical level in three layers: first, the individual actions labelled outcomes from the individual-technological relationship (the micro-level); second, the social relations labelled as socio-technical outcomes (macro-level); and third, the societal layer, the conditioning context of the PBO.

3.2 Descriptive and interpretative framing

Critical realists recognize that there is always a descriptive part and an interpretative part in studying phenomena and the mechanisms that produce these phenomena. Markus and Silver (2008) recommend a hermeneutical approach as suitable for CR. We use hermeneutics to understand phenomena through the meanings that people assign to them (Klein and Myers, 1999). Any hermeneutic study starts with a

pre-understanding of the context in question and a pre-supposition of what is deemed significant. We study individuated individuals in PBOs and focus on how socio-technical changes unfold. These individuals have a large amount of autonomy and are free to decide how, where and when they work. For them to carry out work, they apply a wide range of mobile devices, communication, information and collaborative apps in combination with enterprise platform-technology. Most of their communicative and collaborative activities are mediated either in an asynchronous or synchronous fashion. Our pre-supposition is that in the PBO setting socio-technical changes unfold differently than explained in prior theories. The hermeneutic circle is central to our approach. The cyclic process of understanding a social phenomenon can only be reached by a dialectic process of narrowing the scope of generic concepts concerning it, and identifying within the 'whole' the hierarchy of topics and subordinate topics that constitute the whole (Butler, 1998). We apply Donati's understanding of an open system to identify the hierarchy of topics. According to Donati (2015), GMs enter a social structure (the PBO-setting) that generates a tendency in outcomes (individual-technical and social-technical). This structure is relational. The outcomes have a type of regularity (between individual actions and social relations). The type of regularity will depend on the relationality peculiar to its structure. In the PBO, the individual populates the micro-level, whereas the social relations are located at the macro-level. The macro-level outcomes emerge from the micro-level. The relations on the macro-level exert downward causation from actors on the micro-level (Donati, 2015). In applying a hermeneutic cyclic interpretation, while preserving analytical dualism between the individual, the social, and the technical, we introduce three steps of interpretation to answer the RQ. Step 1: We interpret observable outcomes at the individual-technical (micro) level and at the socio-technical (macro) level and interpret the tendencies. Step 2: We interpret the regularities in the system. These regularities depend on the relationality that is distinct to the structure of PBOs. Step 3: We interpret the GMs that cause these outcomes, tendencies and regularities. These steps will eventually lead us to a final interpretation of how socio-technical change is obtained in PBOs.

3.3 Study design and data-collection

We have designed an exploratory exercise to gain knowledge of individuated individuals in the work-setting of PBOs. Frey and Fontana (1991) promote group interviews, when studying work-environments. We will bring together a group of knowledgeable people who are familiar with the situation and setting, moderating a discussion that can revise or solidify our pre-supposition of reality in this setting. Group interviews add a dimension to the knowledge of everyday life that we might overlook or miss if the data collection method had been limited to one-on-one interviews. It adds intersubjectivity, i.e. agreement of meaning and shared ordinary descriptions of reality. We choose e-group discussions to conduct the research in context (Yin, 2004). Collecting data in e-groups serves many purposes as opposed to off-line group data collection. First, it gives access to participants who are difficult to recruit; second, participation is convenient and easy; third, participation is more balanced in terms of the number of comments made by the members (Murgado-Armenteros, Torres-Ruiz and Zamora, 2012). We chose a critical case sampling technique particularly useful in exploratory research, where a small sampling can be decisive enough to explain the phenomenon of interest. This technique can help make logical generalisations; however, we will make them with caution. We sought individuals from different enterprises, sharing the social-setting of a PBO and made a convenience sampling by posting a request on one of the author's LinkedIn page (with +1200 contacts) in June 2017. We asked for participation in research from people interested in the phenomenon *new ways of working*, a commonly used label of digital work-settings (+182,000 matches in Google) and a broad enough theme to attract as many as possible. +30 people responded and careful screening of participants began. Our first inclusion criteria was working in PBOs i.e. performing work primarily via digital supports and with a positive attitude towards exploring and improvising with technology for work-related issues. Then we asked into industry, gender, educational level, size of enterprise, role and age. We chose the group in table 1, representing a variety of PBO settings, sharing the same conditioning meta-context, interest and attitude towards tinkering.

#	Industry	Gender	Edu.	Company (year founded/# of employees)	Role	Age
1	Fintech	F	Master	One-man (2014/1)	Advisor	27
2	Education	F	Master	Start-up (2015/+9)	Consultant	47
3	Telecom	M	Master	Enterprise (1889/+7000)	Director	32
4	Recruitment	M	Master	Start-up (2017/+8)	CEO	40
5	Art. Intelligence	M	Master	Start-up (2016/+35)	Manager	47
6	Software	M	Master	Enterprise (1985/+120.000)	Manager	53
7	Food	M	Bach.	Enterprise (1866/+330.000)	Director	42
8	SW-Infra-struct.	M	Master	Enterprise (1989/+ +8000)	Consultant	45
9	Architecture	M	Master	Enterprise (2005/+400)	Consultant	31
10	Cloud service	M	Bach	Start-up (2016/+9)	CEO	42
11	Online Shop	F	Bach.	One-man (2013/1)	Advisor	46

Table 1. Participants

We gathered all respondents in a closed group on Facebook. The first post was a warm welcome from the facilitator (one of the authors), explaining the basic ground rules of the group interview. The respondents identified themselves with names and used their regular profile portrait. This contributed to an informal atmosphere. In advance, we had created a semi-structured qualitative guide of six broad questions using practical focus group questioning techniques (open-ended questions starting with an engagement question followed by exploration questions). To counter misunderstandings, the basic structure of each question was the specific question, some background explanation, and an instruction in how to answer (i.e. *First, address xx, then, include xx and finally, reflect on xx*). Follow up questions came along the lines of: *Is this ideal? Is this your preferred way?* A great variety of length/language/personal opinions and perspectives flourished. We asked the following questions: 1. Describe the last time you made a technology related change to your work, and for what purpose. 2. Think back: what has changed the most during the last three years in how you carry out work? 3. Reflect on the influence of culture, technology and the structure of work in terms of organizational influence and individual influence – give small examples? 4. What in your opinion kills productivity the most? 5. In what type of organization do you work (hierarchy, flat-archy or a mix) and how does technology support this type? 6. We then used a minor poll to exit and sum up the session. We ended the e-group after two weeks and copied all the text from each question into a word document amounting to 20 text pages. We conducted the first round of interpretation using directed coding. We looked for experiences related to technology of all types (apps/platforms/devices), and aspects pertaining to individual behaviour. These aspects included shared behaviour; choices; coping with/balancing actions; tinkering/improvisation; influence from/on routines, processes, practices and structures; changes; improvements; productivity; and orientation towards individual interest and social commitment. The codes were used in combinations of two and three. Example: re-programmed e-mail (technology) notification in my in-box (individual) for productivity issues (productivity); Then we proceeded with the three interpretation steps from section 3.2.

4 Findings

In table 2, we confirm outcomes from the individual-technical relationship at the micro-level and the outcomes from the socio-technical relationship at the macro-level. We complete step 1 by describing the tendencies on each level in table 3. In table 4, we report the findings of regularities in the system, ending step 2. Step 3 is covered, when we interpret if GMs from the societal-level and external environment have entered the system and exerted downward causation. Finally, we can answer how socio-technical change is achieved in the setting of PBOs.

We identified four outcomes from the individual-technical (I-T) relationship and three outcomes from the socio-technical (S-T), see table 2.

I-T: Individuals digitize information and digitalize routines: People explore on their own and test new apps and devices that support digitization and digitalization of work. With these apps, they make big and small improvements, to enhance productivity. #6*: "I made the switch to digital and take most of my notes in One-Note. Main motivation was to enable sharing of the notes". #11: Installed a new travel document app so every document for travels are accessible. Works like a charm". #10: "data synchronization has changed the way I work. I'm a sucker for technology and I have an enormous amount of devices. I have exactly the same access to everything across all platforms. I can work from everywhere with the same efficiency.*
I-T: Individuals seek instant knowledge sharing through informal channels, in smaller groups. Constant improvement of fast and easy access to information from knowledgeable people are essential. It also serves as a way to lessen the burden from e-mails and misunderstandings. #3: *"I introduced Slack …wanted a common place where [my team] was able to follow questions/answers to increase knowledge sharing across organizational and geographical boundaries [this has] limited the amount of emails and made the discussions less formal". #4:"I spend more time communicating with colleagues through Trello and Slack, which both result in performance increase and clarity when it comes to execution (who does what, when?)"*
I-T: Individuals store personal data in the cloud to centralize for easy access and for sharing with others. Much more mobility, from having access to personal and organizational data in one place enhance productivity. *#7:"Now we work 99% with-out paper and all is stored in the cloud […] This change give me the opportunity to follow and monitor trends in a snapshot of time". #8: "[I'm more] mobile in my work style. I am able to access my files and needed tools from anywhere. I can work from anywhere […] can still get access to all the needed apps from any device as they are all in the cloud".*
I-T: Individuals individualize communication routines and take full responsibility of own productivity. They experiment with new practices to get things done smarter and faster. *#1: "Today my communication is more spread out: I get work-related messages on LinkedIn, Facebook, e-mail, private, Slack, Skype, My work is more effective: […] I don't check e-mail (and other communication platforms) too much and I don't HAVE to answer an email right away. It can wait so I can get my work done. #3: "[I have control over] installing applications that is fit for my tasks. The Slack-application is on my own and is use with the team".#5: I have reprogrammed my e-mail in-box to update three times a day, this saves me a lot of time to concentrate.*
S-T: Transparency comes from cloud solutions that centralize data and change information-structures. The accessibility and interest in up-to-date data happen between an alignment of data and technology. *#10:" All employees and investors have installed the Geckoboard app on their iPhones which give us all live data and statistics.… transparency and focus on the most important KPI's, so everybody in our organization is aligned when we are talking about numbers, targets etc.*
S-T: Standardizing workflows in enterprise-wide-platforms are necessary for optimizing work and increasing speed. *#4: "In order to be aligned and to structure project/product development we are forced to use the same software…in order to work optimal everybody needs to use it in exactly the same way, this […] limits the misunderstandings and powers up the speed". #8: "The organization defines which IT solutions to use (CRM, Mail, Office SW, Computer, FileSharing) and how we should use the systems - especially CRM..*
S-T: When working together, technology-usage requires a shared understanding of how and what to use. *#1: I can freely use the tools I want for myself, but I have to use the tools of others, when I help them out …this could be them using Slack to communicate…Facebook/LinkedIn - I have to be there to get their messages. So the technology does have some control of me. #2: "there should be some structure … the bigger and more professional the more, the organization need to tighten the grip on knowledge sharing and security etc. otherwise it would make it difficult to work together".*

Table 2. Individual-Technical (I-T) and Socio-technical (S-T) out-comes in the setting of PBO

We define tendencies as the inclination toward a particular type of behaviour. When we interpret tendencies, we seek to infer the *current in the river* as an underlying sequence of events at each level. Table 3 explains the interpreted tendencies from out-comes.

Tendency at the micro-level of outcomes from the individual-technical interaction
Digitizing personal information and digitalizing routines leads to individualization. Individuals speed up collaboration with informal Q/A applications and instant knowledge sharing routines through face-time, notes, apps etc. Cloud-access and storage are essential to access and share personal information. The individual constantly improvises with technology and introduces apps into personal routines (i.e., appify) to become even more productive through a think-cloud and fast-access mind-set.

Tendency at the macro-level from the out-comes at the social-technical interaction
Centralization of data is important. This implies alignment of IT-enterprise system and workflows. Standardized input is required. This creates transparency and gives instant and always access for everybody. Decisions become data-driven. The data and platform driven approach institutionalizes work through platforms. The organization platformize processes to become even more efficient through a think-cloud and data-control mind-set.

Table 3. Tendencies at the micro and macro level of PBOs

In summary, individual innovation happens at the individual-technical level in terms of choosing how to engage with data and stay productive. The objective of change is routines and practices; this in turn influences structures relating to communication and coordination activities. We find that the surface level inhabits agility, based on a mind-set denoted as think-cloud and fast-access of data. At the macro-level, more and more rigidity is required due to standard workflows from enterprise-wide platforms. The change objectives are business processes and structures. We find that strictness now inhabits the deep level in the system, based in the mind-set denoted as think-cloud and control of data.

In table 4, we show the regularities found in the data as *a rhythm*. The interpretation covers how the individual-social-technical relationship advance meaningfully between two realities interacting on the surface and the deep level, uncovered in the prior steps of interpretation. Constant balancing constitutes the rhythm in the system. This rhythm supervenes according to the way that the relational structuring of the system advances. It is a *both/and*, simultaneously actualized between the social and the individual level. We found four regularities that constitute the rhythm. R1: Technological-strictness *and* technological-autonomy. R2: Effectiveness through platform processes *and* creativity from individual actions. R3: Standardization of data-input workflows *and* free flow of personal data. R4: Company control *and* individual freedom. In some instances (R2 and R4) people "drop-off" this rhythm and decide to "unplug". The rhythm supervenes from the contradictory-complementary dynamic of increased instability from surface structures and increased stability in the deep level structures.

R1: Balance between technological-strictness and technological-autonomy. *#7:"Within the system we are free make amendments to the usage of the tools available.* A*ll programs or downloads […] need to be from the [company name] cloud store". This makes testing new ways of work difficult. We are free to combine existing [cloud services] to improve WOW like what's app, Skype, chatter, video conference […] to experiment."*
R2: Balance between effectiveness from platforms and creative individual actions. *#1: "Technology makes many processes more effective, but also enables many distractions and people expecting me to react asap, which has forced me to delete apps such as Instagram, Snapchat and Facebook on my phone" #8:" I enjoy the sales processes if they work, but they don't work for me. And I would like to have much more autonomy over my tools, techniques and teams. But I get a totally different balance when I start on my own the 1 Oct".*
R3: Balance between standardization and free flow of data. *#5: "We have adopted BOYD, and all our data is in the cloud. We have adopted and standardized several tools and services. We will work hard to keep that "balance" as we want to remain innovative and creative - and this, in my mind, means that an enterprise should dictate at little as possible, and keep an open mind". #6: "With respect to tech setup and freedom […] we [have] lots of freedom but a few things are fiercely enforced".*
R4: Balance between control and freedom. *#7: "The ideal split would be to have control and at the same time empower the individual to take responsibility for [exploration] and development of processes and WOW (ways of working) #9: "We are provided phones, computer, programs, means of communication (Skype, GoToMeeting, Outlook etc), project controlling applications. We have structures and naming convention for files. At the same time we have full administrative rights to install and use programs such as Wunderlist, Evernote etc".*

Table 4. Regularities

Based on the regularities uncovered, we find that the contradictory complementary GM of socialization and individualization has *entered the system*. In a socio-technical change-perspective *socialization* is the social adoption of technologies into shared ways of doing things and the understanding thereof. Socialization supervenes from the institutionalizing power of platform-technology as deep structures. *Individualization* (in this context) is the act of autonomous actions relating to designing individual interaction

at the surface level. We observe experimentation with technologies that loosens the influence from the deep structure. Downward causation from the GM is likewise observable. Individualization supervenes from socialization when the platform-technology establishes deep structures. Then the individuals explore, tweak and innovate routines on the surface structures; Personal apps and devices enable such individualization.

The findings suggest that an *equilibrium paradox* exists in a system that has surface structures that are approaching a state of disequilibrium (unstable equilibrium) while the deep structures simultaneously approach a state of equilibrium (quasi-equilibrium). The findings suggest that such a paradox is now characteristic of PBOs. The equilibrium paradox is the outcome of a contradictory complementarity mechanism of individualization and socialization that now inhabits the socio-technical system. One example of what causes an equilibrium paradox is the increase in cloud-based data. Cloud-based data is accessible from anywhere, anytime, from any device. Organizational data-driven decisions require platforms that dictate input formats and workflows. The platforms thus structure the work processes. This in turn improves the individuated individual's mobility and flexibility. Changes to individual routines and practices increase. In summary, the individuated individual increasingly *appifies* (introduce apps into) routines and practices i.e. individualization, while the organization *platformizes* processes and structures i.e. socialization.

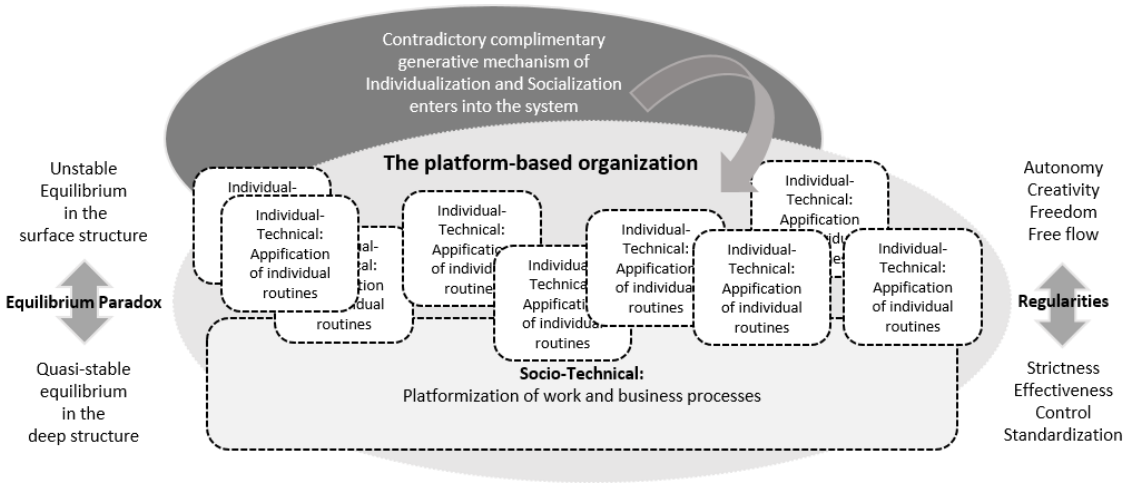

Figure 1. Socio-technical change: the equilibrium paradox

Figure 1 is an explanatory model of how socio-technical change is achieved in PBOs. The influence from the GM is illustrated with the grey curved arrow. Change is achieved through the deep structures that inhabit a (set of) platform (s) at the socio-technical level. Agility inhabits the surface structures due to the array of platform interfaces that permit interoperability with a wide variety of "plug-in" technologies at the individual-technical level. Innovation occurs only at the individual-technical surface structures. Surface equilibrium in the individual-technical relationship becomes unstable, based on individual preferences – "plug-in" also means "plug-off", i.e., breakdown. The instability arises from individual actions that sometimes include unplugging from the socio-technical level. The IS social deep structures are mirrored in the platform, fostering a shared way of thinking and working. At both levels, the mind frame becomes *think-cloud and access-to-data*. The social adapts to the platform and individualization arise within socialization in the choice of surface technologies. As a result, the surface equilibrium of the social is unstable. This scenario yields an equilibrium paradox between the quasi-stable equilibrium in the deep structures that inhabit the platform and the unstable equilibrium that inhabits the surface structures. The quasi-stable equilibrium at the deeper level sets up the conditions for an unstable equilibrium at the surface level.

5 Discussion

Although the current study is based on a small sample of participants, the findings suggest several contributions to the IS literature. Primarily, we found that the concept of the equilibrium paradox helps explain how socio-technical change is unfolding in today's PBOs. The equilibrium paradox is an original contribution with roots in previous research into punctuated equilibria (Lyytinen and Newman, 2008; Tushman and Romanelli, 1985). This idea also has roots in the work on the fragility of an equilibrium as leading inevitably to an unstable equilibrium situation (J.R. Hicks in Metzler, 1946). Aside from making an original contribution on its own, the equilibrium paradox also extends prior literature on change, particularly in elaborating the conceptualization of contradictory complementarity as a social dimension of an unstable equilibrium. This aspect of the paradox extends previous research by offering a more elaborate explanation of events at the surface level in relation to events at the deep structure level (e.g., Gersick, 1992; Lyytinen amd Newman, 2008; Besson and Rowe, 2012).

We also provide a fresh perspective on the role of surface and deep structures in relation to change in platform-based organizations today. Change in surface structures is assumed in much research to be dependent on change in deep structures (Wand and Weber 1995; Volkoff and Strong 2010, Lyytinen and Newman, 2006;2008). We challenge assumptions that the periodicity of disequilibrium is a matter of disruptions in the deep structures. Such assumptions unnecessarily inhabit the punctuated equilibrium model. We offer an elaboration path for the punctuated equilibrium model that considers surface structures as the center of emergence in PBO's. We extend the fundamental work on surface structures and deep structures in suggesting that, for PBO's, instability in the surface structures can drive change in those surface structures to a more independent degree from the quasi-stable equilibrium of deep structures. This independence is one enabler of the equilibrium paradox. Thus, we provide another perspective of the quasi-stable equilibrium than Swanson (2017) and Lee (2010).

We also contribute an updated theory of the PBO. Some of the original work on platform organizations described these as being capable of generating different organizational forms that were appropriate for momentary situations (Ciborra, 1996). We extend this theory to incorporate technological platforms, such as ERP systems or cloud systems that both shape and constrain the ability to generate agility. The notion of PBOs elaborates the concept of platform organizations in recognizing the dominant technological basis of platforms today (Zammuto et al, 2007). As a result, our research suggests that obtaining socio-technical change in PBOs is now anchored to our understanding of the relationship between the technological, individual and social aspects of surface and deep structures.

Finally, we provide several advances on other, more fundamental, research. We confirm assumptions of analytical dualism to explain complex socio-technical changes that appear more elastic, unstable and resilient (Donati, 2015). We have also added evidence of a new GM that has entered the world of work. This GM, denoted as individualization and socialization, can explain how different states of equilibrium can simultaneously inhabit different levels of reality (Gersick, 1992).

We contribute new explanations for how organizations are emerging by applying the socio-technical perspective - identified by Mumford (2006) and Eason (2008) - by challenging the inherently linear logic in previous socio-technical research. This challenge suggests a new causal logic for emergence.

Despite the small sample, we make the logical generalization that PBOs inhabit possibilities of enforcing organizational data regimes, while simultaneously catering to the individuated individual's autonomy. In the data-driven future, we suspect that enterprises will look for leadership models that can deliver on this *both/and* agenda of simultaneous stability and agility. This involves more knowledge of how to trigger the GM of socialization and individualization properly without causing breakdowns (Hofkirchner, 2014). This eventually involves further examination of the concept of data and information conceptualized as a commons (Hess and Ostrom, 2007) i.e. as a common good (Hofkirchner, 2014) and the mutual relation to individualization (Castells, 2014).

The limitations that characterize our research open opportunities for future work. For example, we have only considered a limited number of individuals in PBO settings. More research is needed to investigate whether the equilibrium paradox inhabits specific kinds of organizational forms. Future quantitative

research is required to investigate if the equilibrium paradox can be detected within larger, normal, and more random datasets. The discussions were conducted as online group sessions with written responses. Future research should investigate whether this interpretation will hold for an intense qualitative investigation using single interviews and observations. Finally, we did not analyze the contingencies of socio-economic data.

6 Conclusion

Despite its exploratory nature, this study offers insight into socio-technical change in PBOs. We explain socio-technical change based on GMs that create paradoxes and regularities that are essentially contradictory complementary. Notwithstanding the limitations, the study questions not only the assumptions that the ideal IS will exhibit a balance between its social and the technical structures, but also questions whether such an ideal system endures with some degree of periodicity in its state as a stable equilibrium. These assumptions no longer provide a full explanation of the complex dynamics in today's enterprises. These dynamics incorporate an unstable equilibrium that arises in the continuous change that individuals make in socio-technical structures. We explain how a mechanism of contradictory complementarity, denoted as individualization and socialization, now inhabits the organizational system and causes events that are both individual-technical and socio-technical. This mechanism drives changes at the surface level of organizational structures, a level in which structures exist in an unstable equilibrium. Rather than driving the surface structures, the deep structures instead remain in a quasi-stable equilibrium. This equilibrium paradox in socio-technical change explains how PBOs achieve change by achieving agility from their IS while simultaneously embracing quasi-immutable platforms.

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