Extending the Social Construction of Technology (SCOT) Framework to the Digital World

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Research-in-Progress

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Abstract

The rapid rise of digital technologies forces us to re-think our current conceptualization of Information Technologies (IT) where recent theoretical approaches like complexity, evolutionary and network theories tend to remain silent on human (managerial and organizational) choices underlying the development of digital technologies. In this Research-in-Progress paper, we first describe the Social Construction of Technology (SCOT) framework, originating in the 1980s. We then propose extending the SCOT framework along four dimensions in order to ensure its suitability for the digital world: (1) Technology – focus towards digital technologies, (2) Interaction – focus on interpersonal, person-technology, technology-technology and technology-physical environment interactions (3) Social Groups – focus on networked individualism, and (4) Context – focus on socio-digital context. We conclude by proposing to co-develop and -test the extended framework as a joint effort across several academic disciplines in order to use it when conducting research on the social construction of digital ecosystems.

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Introduction

Managing digital Information Technologies (IT) is complex. The very nature and development of recent digital technologies (e.g., cloud computing digital platforms, Internet of Things, Industrial Internet, robotics, wearables, 3D-printing, and Virtual and Augmented Reality) has led to a ‘new reality’ (Yoo et al. 2010); a ‘new stage of evolution of IT’ (Tilson et al. 2010) which forces us to rethink and re-conceptualize traditional IT-strategies and -thinking (Bharadwaj et al. 2013; El Sawy et al. 2013).

This emerging role of IT has been accompanied with a growing interest in adopting ecosystems as an analytical lens, leading to inclusion of theories and concepts from other disciplines like complexity science (McKelvey et al. 2016), biology (Iansiti and Levien 2004), innovation theory (Christensen 1997) and (network) economics (Birke 2009). These ‘new’ theories in Information Systems (IS) research may be helpful in explaining the complexity, connectedness, and dynamics of digital technologies at an abstract and high aggregation level. Yet they tend to remain silent on human (managerial) choices in the context of developing and constructing new technologies. That is, agency remains ‘undertheorized’ (Gulati and Srivastava 2014) when investigating the nature, the construction, and the consequences of digital technologies.

Moreover, applying these ecosystem theories to digital technologies tends to build to a certain degree on what Leonardi and Barley (2008, p. 160) coined (digital) ‘technology determinism’. In contrast to voluntarism, determinism “… holds that our actions are caused by technological, cultural and other forces prior to, external to, and independent of our behavior“. Technologists, historians, sociologists, and philosophers of technology have discussed such technology determinism for many years and proposed alternative conceptualizations (Orlikowski 2010; Pinch and Bijker 1984), yet this heritage seems mostly ignored in current research on digital technologies.

Recent technological advancements have led to the spread of digital ecosystems raising additional questions concerning the relationships between technological evolution and human choices in the context of constructing and using such technologies. These questions need to be addressed for academic, practical and societal reasons. However – in spite of rich discussions on various aspects of digital ecosystems in academic publications – we currently miss research efforts focusing on the peculiarities of constructing and using them.

Hence, in this paper we call for reviving a framework geared towards addressing the concerns raised above: the Social Construction of Technology (SCOT) (Bijker et al. 1987). We propose extending it to a Social Construction of Digital Technologies (SCODT) framework – enabling today’s researchers to dig deeper into the construction and use of increasingly pervasive digital ecosystems (Wareham et al. 2014).

The Social Construction of Technology (SCOT) Framework

Pinch and Bijker’s (1984) seminal article “The Social Construction of Facts and Artifacts: Or how the Sociology of Science and the Sociology of Technology Might Benefit Each Other” laid the foundation of the SCOT framework, a generic framework for the social construction of past and present technologies. It offers an alternative to deterministic views on the development of technology (Williams and Edge 1996). Since then, often in conjunction with technology development beyond physical artifacts, numerous researchers (e.g., Faulkner and Runde 2009; Klein and Kleinmann 2002; Leonardi 2009) have used the SCOT framework and contributed to its further development.

Within the SCOT framework, the *artifact* with its specific attributes is at the core of the analysis and defines the relevant social groups. Technology construction differs to a large extent depending on the technical composition of the artifact in combination with relevant social groups.[1] Williams and Edge’s (1996) emphasize how various types of IT), i.e., architecture, hardware, software, applications, inter-organizational networks, appear to be different in their negotiability and fluidity with respect to social construction. Bijker et al. (1987) acknowledge that – based on their materiality (obduracy) – some technologies are harder to alter than others (Sunga and Hopkins 2006). Doherty et al. (2006) show how

[1] However, in top (ISR) research publications in the 1990s, "IT artifacts are either absent, black-boxed, abstracted from social life, or reduced to surrogate measures.” (Orlikowski and Iacono , 2001, p. 1047).

technical IT properties might constrain the interpretative flexibility and moderate the extent to which the system design can be changed.

In contrast to views proposing that the development of a technological artifact progresses in a series of linear stages, Pinch and Bijker (1984) present artifact construction and use as a *multi-directional process*. The multi-directness refers to different routes that are negotiated by the different social groups involved, often leading to a higher degree of unpredictability. To picture such rather unpredictable development of a technology, Selwyn (2012) uses Jorge Louis Borges' phrase the "garden of forking paths" (p. 87). Bijker et al (1987) argue that developing technology in a series of stages cannot result in one 'best' design when taking into account that different social groups have vested interests in and consequently divergent interpretations of the technology (interpretative flexibility).

Social groups attempt to influence the design and use of technology; they use various mechanisms to 'close' the technology design in a particular way. That is, they attempt to reduce the ability to allow for alternative interpretations (Selwyn 2012). Pinch and Bijker (1984) distinguish two mechanisms for technology closure (but there are many more): (a) rhetorical closure and (b) closure by redefining the problem. In the case of rhetorical closure, one or more relevant social groups claim that the problem has been solved by the technology. In closure by redefining the problem, relevant social groups are able to redefine the problem in such a way as to establish consensus with other social relevant groups – thereby neutralizing arguments for alternative interpretations.

Bijker et al. (1987) emphasize a *wider social context* to situate and explain diverging interpretations of relevant social groups who differ in terms of power, access to resources to influence the artifact, and cognitive abilities and technology frames to assess the potential of a new artifact.[2] Similarly, later SCOT researchers underpin the relationships among the relevant social groups and the wider social context in which the social construction of the technology takes place.

Over the last two decades, constructivist perspectives on technology development have become widely accepted. They differ with respect to the social phenomena they study and the processes by which the construction occurs (Leonardi and Barley 2010). Introducing the above briefly outlined SCOT framework has led to more attention for less successful social groups in the construction of technology. It has illuminated mechanisms by which different social groups attempt to close and stabilize technologies and impacts thereof on others.

Some researchers praise that deploying the SCOT framework has opened the 'black box of technology' (for a review see Williams and Edge 1996). However, Winner (1993) criticizes that the SCOT framework strictly focusses on constructing technologies. SCOT "shows an apparent disdain for anything resembling an evaluative stance or particular moral or political principles that might help people judge the possibilities that technologies present. … Interpretative flexibility soon becomes moral and political indifference" (pp. 371-372). Critical stances with respect to SCOT (e.g., Klein and Kleinmann 2002; Winner 1993,) encourage us to further develop the SCOT framework, especially in the increasingly digital world. As new technologies have become pervasive and ubiquitous (Eaton et al. 2011) in the digital world, they differ from traditional (organizational) IT in terms of programmability, accessibility, interactivity, addressability, and traceability (Kallinikos et al. 2013; Yoo et al. 2010). These new features allow for more human interference in the evolution of (digital) technologies. Yet the current SCOT framework needs extension to analyze the implications of digital technologies and associated human interference.

In the next section, we will briefly outline digital ecosystems to show how they are socially constructed instead of understanding them as evolving without much theorizing on the role of human agency.

[2] For an overview on SCOT-based studies focusing on the wider social context of technology construction, see Klein and Kleinmann (2002), or Selwyn (2012).

Research Context: Digital Ecosystems as a Socially Constructed 'Artifact' in the Digital World

The phenomenon of digital ecosystems refers to '…the combination of all relevant digital touchpoints, the people that interact with them, and the business processes and technology environment that support both' (McCormack 2011). Digital ecosystems typically deploy a technical platform that supports interconnection and thus determines which connectors will be included or excluded; examples are services oriented architectures and cloud computing platforms (Yoo et al. 2012).

Most digital ecosystems come across as expanded partner networks that are typically assembled by 'orchestrators' (Markus and Loebbecke 2013). Organizations in an ecosystem include not just customers and suppliers, but also producers of complementary products and services, logistics providers, outsourcers, and financiers.[3] Actors require large-scale interoperability, which is typically based on data and business process standards (Markus and Loebbecke 2013). The diverging interests and value creation processes of different actors – or stakeholders – in various social groups (Geels 2002) pose new challenges to the construction of digital ecosystems. Balancing the give and take of individual stakeholders has become more complex than in common dyadic relationships between firms with a partially shared interest which may be characterized as cooperative or coopetitive (van Fenema and Loebbecke 2014). Major organizations strive for dominance of the platform they advocate (Markus and Loebbecke 2013; Yoo et al. 2012) which requires designing for complex protagonist-antagonist interactions (Eaton et al. 2011). Stakeholders such as public organizations aim at serving a collective interest and addressing high level dilemmas – e.g., privacy and security – rather than satisfaction of a particular customer base (Moore 1995; Stoker 2006).

The current notion of digital ecosystems builds on a research tradition that started in the 1930s in biology-ecology, defining ecosystems as "the combined physical and biological components of an environment" (Clapham 1930, in: Willis 1994, p. 8). Since then, the ecosystem concept was transposed to social and business science and geography, offering a platform for theorizing on phenomena in their broader context (Clarke 2005). With the spread of digital ecosystems in various sectors, they have also become a major topic in IS research. In fact, the resulting literature on digital ecosystems points at various interrelated themes such as interfirm governance around a major orchestrator (Manikas and Hansen 2013; Markus and Loebbecke 2013), strategizing (Henfridsson and Bygstad 2013; Selander et al. 2013), layered platform technologies and service-oriented architectures (Briscoe and De Wilde 2006; Yoo et al. 2012), risks of mutual interdependence, and distributed value creation. The latter "depends on the relative amount of value that is subjectively realized by a target user (or buyer) who is the focus of value creation—whether individual, organization, or society—and that this subjective value realization must at least translate into the user's willingness to exchange a monetary amount for the value received" (Lepak et al. 2007, p. 182). However, works on the social construction of digital ecosystems are scarce which currently limits our understanding of the evolution of digital technologies.

In summary, digital ecosystems build on advanced technologies and typically emphasize new approaches to networked, multi-sided value creation processes in which organizations are embedded (Grover and Kohli 2012; Heikkilae et al. 2014; Nenonen and Storbacka 2010). The construction of digital ecosystems must prepare for interactions between diverse stakeholders across sectoral boundaries. This involves confluence of business, social and technological dimensions taking center stage as researchers grasp inherent complexities of digital ecosystems. SCOT could underpin research along these lines, yet studying the social construction of technologies in the digital world requires a framework extending the well-established SCOT framework.

Towards a Framework for the Social Construction of Digital Technologies (SCODT)

While the assumptions underlying the established SCOT framework are still relevant, they are based on a much earlier (technology) era and hence need to be adjusted for developing a framework that help

[3] Sector-specific examples of digital ecosystems include logistics (Graham et al. 2013), consumer electronics (Yoo et al. 2012), security (Smith 2006), news (Czarniawska 2012), creative entrepreneurship (Kim et al. 2016), financing and crowdfunding, medical informatics, social media, sustainability, and tourism (Orlikowski and Scott 2015).

researchers studying the social construction of digital ecosystems as a rather omnipresent example of the spread of digital technologies.

The established SCOT framework focuses on integrating the various stakeholders and social groups, their interconnectedness, their countless intra- and inter-group interactions, and their respective interests. It offers an approach for revealing emerging (intersecting) narratives in the process of designing digital ecosystems and for explaining socio-technical phenomena of in the context of system construction

However, established SCOT framework seems insufficient for taking into account the nature of digital technologies underpinning digital ecosystems, networked individualists as active stakeholders, the socio-digital context, and the interaction between people and digital technologies – all characterizing digital ecosystems.

Hence, we propose adapting and extending the SCOT framework in the light of digital technologies along four dimensions in order to arrive at the *Social Construction of Digital Technologies (SCODT)* framework. The four dimensions are *technologies*, *interaction*, *social groups*, and *context*:

(1) *Technologies – from organizational IS to digital technologies* underpinning the design digital ecosystems: So far, in IS research SCOT has been mainly applied to clearly distinguishable corporate IS. In light of the digital convergence of technologies (Tilson et al. 2010), we suggest to extend the unit of analysis from information systems to digital ecosystems based on pervasive, global digital technologies.

(2) *Interaction – from interpersonal interaction to interpersonal, person-technology, technology-technology and technology-physical environment interactions*. Whereas the SCOT framework elaborates on the interaction among (human) social groups, the SCODT framework needs to pay attention to how people and technology (e.g., algorithms, sensors in the Internet of Things) interact – perhaps following Latour (1999) that people and things share a similar ontology.

(3) *Social Groups – from relevant social groups to networked individualism*. SCOT used to focus on identifying relevant social groups. The rise of digital ecosystems and global digital infrastructures has facilitated networked individualism: fragmented, opportunistic, fast connecting individuals and organizations forming temporary relevant social groups (Wellman et al. 2003).

(4) *Context – from social context to socio-digital context*. Societies are structured around power asymmetries (Klein and Kleinmann 2002), which give different relevant social groups asymmetric access to (information) resources that are relevant in the construction of technology. In the socio-digital world access to relevant (information) resources becomes more open and widespread. This has implications for the relative power position of relevant individuals and social groups in socio-digital networks and consequently for the construction of (digital) ecosystems.

By moving from SCOT to SCODT along those four dimensions, we propose to extend the social construction-perspective to the development and evolution of digital ecosystems, which we defined as 'combinations of digital touchpoints'. Built on and incorporating omnipresent digital technologies (Dimension 1), those digital touchpoints constitute where different groups of people, processes, and technologies interact (Dimension 2). At these touchpoints, different kinds of interactions may take place: human-human, human-technology, technology-technology. To problematize and investigate these digital touchpoints we pay special attention to the processes by concerns of different individuals and groups are translated (Dimension 3). We assume that – at these digital touchpoints – decisions about the (the direction of the) expansion of the ecosystem provide different socio-relevant groups with the needed access to relevant (information) resources in spite of existing power asymmetries (Dimension 4). Digital ecosystems then can be understood as complex and evolving patterns of digital touchpoints. For instance, a shop owner influencing approaching customers using location based services, and analyzing subsequent customer behavior based on a myriad of digital traces.

Seeing the social construction of digital touchpoints (socio-material meeting points) at the core of the research from the SCODT perspective, the proposed SCODT framework would allow researchers to describe and analyze the construction of digital ecosystems and their ongoing evolution from a socio-digital perspective at new level of detail.

Summary and Outlook

With this paper we firstly proposed to bring the well-established SCOT framework, developed towards the late 20th century, back to the IS research table. To that end, we outlined the main points of the SCOT framework and argue that they are equally relevant to constructing digital ecosystems in today's digital world. However, we argued, that along four dimensions – technologies, humans, context, and interaction – digital ecosystems pose additional design challenges not sufficiently covered by the traditional SCOT framework. We therefore propose to adapt the SCOT framework to an extended SCODT framework for the social construction of *digital* technologies.

The potential of applying the established SCOT framework to the social construction of digital ecosystems lies in the technology-independent, but theory-rich perspective, which seems to be forgotten too quickly in light of technological developments and the constant call for new frameworks and theories.

While such a SCODT framework is still in its absolute infancy, it could first be co-developed with the joint efforts of researchers stemming from different regions, having backgrounds in diverse academic disciplines, and taking the perspective of several social groups. Then, the framework could be tested in the context of a number of digital ecosystems and subsequently also other digital technologies.

We are convinced that such an effort would lead to a SCODT framework which would be here to stay – as its two main anchor points social construction and digital technologies are here to stay. It would first and foremost allow researchers and practitioners to better understand and shape the social construction of digital ecosystems. Furthermore, it should overall promote IS research efforts by reaching out to neighboring research disciplines – equally relevant to the construction and the use of digital ecosystems and other technologies in the digital world.

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