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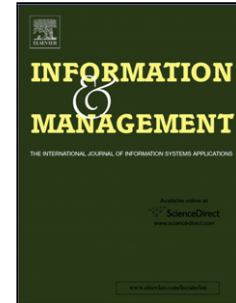
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Toward a Theory of Work-Process Mobilizability

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Abstract

The focus of this theoretical paper is to investigate how mobile information and communication technologies (ICTs) give rise to the notion of organizational fluidity. Drawing upon previous literature, five affordances of mobile ICTs – mobility, connectedness, interoperability, identifiability, and personalization – are discussed. Delving into the concept of organizational fluidity, the paper captures three dimensions of organizational fluidity, namely, team fluidity, task fluidity, and control fluidity. The paper then develops propositions on how different combinations of the mobile ICT affordances influence each of the dimensions of organizational fluidity. The contributions and implications of the paper are discussed.

Introduction: Mobile ICTs and Organizational Fluidity

Work enabled by mobile information and communication technologies (ICTs) has become a regular phenomenon in the current business landscape [3, 44, 45]. Such work, often referred to as mobile work [126], refers to work conducted “in settings where physically distributed and mobile people interact through digital infrastructures and mobile tools to perform their tasks in an organizational context that has a mobility oriented structure and culture” [3, p. 7]. Mobile work is related to the possibility of a human agent moving and executing tasks anywhere and at any time [127, p. 14], often with the aid of wireless technologies (ibid).

The emerging paradigm of mobile work is very relevant to many organizations. Researchers discussing the potential of a mobile workforce contend that we are possibly at the threshold of a “profound increase in human freedom in business” [69, p. 17], where tasks can be autonomously carried out by mobile agents [70], leading to a paradigm of “empowerment” for such workers [118]. Mobile workers are moving out of the strict purview of organizational boundaries, thus changing the nature of organizations themselves [7] and highlighting that organizations are not “tied to particular places or times” [47, p. 90]. As mentioned elsewhere [135, p. 777], organizational employees can now work while they are “spatially and temporally decoupled from one another” and that getting the work done has become more important than the notion of when and where the work is done. The mobile virtual workers are not strictly tied to organizational boundaries; thus, they may be viewed as “postmodern” professionals [49].

Much of the above observations point us to the notion that using mobile ICTs for work encourages and implements the important notion of *organizational fluidity*. Organizational fluidity has become a relevant concept in recent years where the organizations are conceived as being boundaryless [140] with “more flexible and less hierarchical forms compared with

traditional structures” [140, p. 752], in order to meet the challenges and unpredictability of modern-day business environments [90]. Often, such fluid organizations are characterized by speed and agility, complexity and unpredictability, and individual freedom and spontaneity [106], where traditional attributes of organizational work – such as roles, tasks, temporal rhythms, and work locations – are viewed as changing and flexible. It is therefore not surprising that such organizational fluidity, enabled by mobile ICTs, is salient to many organizations’ survival, innovation, adaptation, and success. For example, studies indicate that the usage of mobile ICTs leads to significant organizational benefits [99] aided by the “connectivity, flexibility, interactivity, and location awareness” [109, p. 273].

Organizational fluidity is an emerging concept, which at the same time is becoming relevant in the current business landscape [93]; furthermore, there is substantial consensus in the literature that mobile ICTs contribute to this organizational fluidity. DuxBerry and Smart [27, p. 272] eloquently capture the role of mobile ICTs in this regard, articulating how mobile ICTs help achieve many characteristics associated with the notion of organizational fluidity, such as “blurred boundaries” between professional and personal lives, multiple roles and tasks, and freedom to communicate in a synchronous and asynchronous manner:

...mobility technology has blurred the boundaries between work and non-work... Employees who use mobile technology often find themselves inhabiting multiple worlds and multiple roles simultaneously...and existing synchronously in two environments, a physical one and a virtual one...For these individuals, boundary transitions are both more frequent and more challenging....

Motivation and Research Question

The nascent literature on organizational fluidity and its relevance to mobile ICTs aid in the investigation of their theoretical relationship. In this context, it is useful to note that researchers have called for a greater theoretical understanding of the implications of mobile

ICTs. They recognize that while there exists extensive research on virtual teams – teams where interaction is mediated by ICTs, allowing team members to work from multiple locations [73] – the advent of mobile ICTs has added additional nuances that previous research has not fully appreciated [32]. Typically,¹ research studies of mobile ICTs focus on specific aspects of how they support mobile work and their design and adoption/use, and they provide a less holistic understanding of the role of mobile ICTs at organizational levels [94]. In fact, van der Heijden and Junglas emphatically state that the organizational implications of mobile ICTs is “in need of new, or more refined, concepts and new theories” [123, p. 249]. On a similar note, Middleton et al. [77] note that one of the fertile areas of future research include the unique impacts of mobile ICTs at organizational levels. Theoretical understanding of such phenomena is specifically important, in light of Scornavacca et al. [107] observing that research in this area *does not have its own theory* as yet, and their argument that this area would lack coherence and solidity unless reinforced through theoretical advancements. In sum, the above observations point to the broad acknowledgement that the IS academic community would benefit from a deeper theoretical understanding of the implications of mobile ICTs to organizations [142].

Given the need for greater theoretical understanding of the implications of mobile ICTs, and their intimate relation to organizational fluidity, which is itself under-researched [43], the aim of this paper is to contribute to this gap in the literature. Specifically, our focus is to link the relatively nascent literature on the organizational implications of mobile ICTs to another comparatively nascent literature on organizational fluidity. Formally, our research question is as follows:

¹For example, please see papers presented in the Hawaii International Conference on System Sciences mini-track on mobile collaboration in the past years, as well as the special section on mobile topics in the *Communications of the ACM* (December 2003).

RQ: How do mobile ICTs enable organizational fluidity?

The paper proceeds as follows: In the next section, we provide brief conceptualizations of organizational fluidity and the organizational action enabled by mobile ICTs (termed as mobile ICT affordances), and we introduce three published cases of mobile work. Then, we develop our theoretical model, based on our reviewed concepts as well as the cases. Finally, we present the contributions of this paper and conclude with future implications.

Literature Review**Work Enabled by Mobile ICTs**

Work enabled by mobile ICTs (alternately, referred to as mobile work in this paper) is a form of virtual work. Virtual work has been mostly understood in previous studies as one where the team members work together “without face-to-face contact, typically via digital technologies that mediate communication...” [6, p. 1486]. It involves an electronic working environment, “in which documents, messages and images and even representations of people, i.e. avatars, are stored, exchanged, retrieved and worked” [3, p. 7]. Such work can be understood as one in which the “physical interaction between people and/or objects [during the course of work] has been removed” [88, p. 278].

Mobile work involves a worker being mobile and “uses information and communication technologies [specifically, mobile ICTs] in a *virtual working space* [emphasis added]” [127, p. 17]. Mobile work has consistently seen recurrent themes such as multilocationality [e.g., 139]. As Haddon and Brynin [36, p. 36] note, mobile work entails “working partly from home and partly from some other sites, including a main workplace....” Most scholars equate mobile work with flexible work that is done using mobile (usually wireless) technologies at *multiple locations*, such as trains, homes, or offices [38, 40]. Indeed, Hislop and Axtell [39, p. 62] understand

mobile work as being synonymous with “multilocation working.” For example, in such multilocal work, employees work and travel across multiple places [12, 128, 129] and may have static bases such as home or office or none at all [38]. Overall, mobile workers are those

“...who spend time travelling and/or working at different locations, who use [mobile] ICTs in their work.... Such work has partly been facilitated by recent developments in mobile computing and communications technologies, e.g., mobile phones, laptop computers, PDA’s, Blackberry email devices”[5, p. 902]

Based on this discussion, mobile work has the following three important characteristics:

1. It involves working at multiple locations (multilocal work).
2. It involves working in a virtual workspace, often without physical, face-to-face interaction.
3. Mobile workers can benefit from the use of mobile ICTs in terms of efficiency and effectiveness in interacting with other human agents and information objects and, more generally, in accomplishing work.

This conception of mobile work reflects the ability to work while mobile. *Working while mobile* refers to work that is “carried out while mobile or at multiple sites” [21, p. 70]. At this point, the role of ICTs becomes most salient because “ICT transformations have expanded the tasks that it is possible to do while mobile” [21, p. 70] and leads to “decorporealization” and to flexibility and freedom typical of multilocal work [21], because it is easy to convert any location to a workplace [78]. Due to the very nature of mobile work, such workers can be part of frequently changing work teams, which are often assembled on demand following ad hoc requirements [59]. Essentially, in many cases, the teams in such a mobile work environment arguably exhibit characteristics of “nonprogrammed coordination” where team structures are extremely fluid and

dynamic [122], and teams may be assembled only for the duration of a single, often immediate objective [43]; members in such teams are often part of multiple projects at the same time [83].

Organizational Fluidity

While the idea of organizational fluidity has been around for a long period [e.g., 86], it has attracted mainstream academic interest only recently [106]. This is partly because the rapid advancement of ICTs in recent years has created multiple dynamic possibilities of organizing [26]. Organizations today are spatially differentiated, temporally differentiated, and structurally differentiated [29] and need “to adjust fluidly to unanticipated situations” [29, 1264]. In this respect, the fluidity of organizations involves organizations being able to improvise and innovate within their environments [24] – “fluidity in organizational structures can allow disparate organizations the flexibility to respond in different ways to varied conditions and situations” [34, p. 707].

The concept of fluidity becomes particularly significant in virtual environments [31]. As noted, “fluidity engenders a dynamic flow of resources in and out of the community [which can be broadly understood to be the organization within this paper’s context]—resources such as passion, time, identity, social disembodiment of ideas, socially ambiguous identities, and temporary convergence” [31, p. 1224]. Further, Faraj et al. [31] highlight the need for greater theorization about fluidity. Interestingly, they argue that “fluidity requires us to look at the dynamics—i.e., the continuous and rapid changes in resources—rather than the presence or the structural form of the resources” (p. 1226).

One may note that the concept of fluidity is empirically under-researched [31, 43]. One of the primary aims of our work is to build on this concept of organizational fluidity, to stimulate

further investigation (both conceptually and empirically) into this phenomenon. In our paper, we highlight the significance of mobile ICTs to providing such organizational fluidity.

Before further theorization, the notion of organizational fluidity must be discussed. Based on the literature on fluidity, three vital dimensions of organizational fluidity, namely *team fluidity* [43], *task fluidity* [42, 80], and *control fluidity* [60], emerge.

Team fluidity captures the phenomenon of compositional fluidity, where “teams exist only for the duration of a single project and are composed of members who may join or leave a team during the course of that project” [43, p. 85]. Fluid teams are “groups with unstable membership that organizations create and hold responsible for one or more outcomes” [14, p. 181] and arise due to a number of reasons including flexible personnel allocation, high turnover, and requirement of varying skills across the duration of the project (*ibid*). *Task fluidity* is the variability in terms of acts that need to be performed, as well as the variability in how individual inputs, in terms of frequency, timing, and setting, are related and sequenced to produce task outcomes [80]. Finally, *control fluidity* captures the phenomenon of “free control” where human agents are flexible, autonomous, and mobile, yet tied to the organization by being part of an information network, which implements organizational norms that are cocreated by the human agents in the first place [60].

Affordances of Mobile ICTs as key to fluid organizing

Our previous discussions point us to the notion that mobile ICTs encourage organizational fluidity. Indeed, it is important to note that prior research has commonly used the metaphor of fluidity to capture work enabled by mobile ICTs [e.g., 49, 52, 94, 95, 100]. Supported by the functionalities provided by mobile ICTs, organizations can use mobile work as a means of fluid organizing [113]. For example, mobile ICTs enable “intense and fluid

interaction with a wide range of people” [13, p. 53], which can be argued to influence organizational fluidity. Again, mobile work is characterized by differing temporal patterns and rhythms [98], which can become key to organizational fluidity, innovativeness, and performance [81].

The question then is which theoretical concept/lens best captures the role that mobile ICTs play in fluid organizing. We contend that this can be understood through a lens of IT affordances [72, 140]. Affordances are derived from capabilities provided by IT that *influence newer forms of organizing* [140]. IT affordances can be defined as how the materiality of IT “favors, shapes, or invites, and at the same time constrains, a set of specific uses” within an organizational context [140, p. 752], p. 752). Earlier studies on the role of IT on organizations have built on the concept of IT affordances – describing it as the functional property of the IT artifact in organizations, because it is “what the artifact allows humans to do” [137, p. 222]. In the context of organizations, this implies what IT allows the organizations to achieve.

Carlo et al. [17] understand that different IT capabilities can be differently appropriated in different contexts, giving rise to different affordances in different situations [17]. In the following example, Carlo et al. [17, p. 1084] succinctly capture the concept of affordance, which emanates from IT capabilities:

“An actor who uses a 3-D visualization capability [IT capability] to show the aesthetics of a building’s geometry is appropriating a different IT affordance than an actor who uses the same 3-D visualization capability to improve geometric accuracy in constructing the building. Actors can always choose to...appropriate different affordances of the same IT capabilities.”

The question is thus to investigate the affordances of mobile ICTs that can potentially influence fluid organizing. According to Cousins and Robey [22], mobile ICTs provide five

fundamental affordances: *mobility, connectedness, identifiability, interoperability, and personalization*. We discuss them as follows.²

Mobility

The affordance of mobility is one that enables “to meander and to change location..., often in a *fluid*, unstable way... and, at times, unpredictable to themselves and to others...” [55, p. 285]. The idea of mobility has been articulated in the literature in varying ways. For example, mobility can be locational/spatial, providing the scope of geographical movements of the mobile agent equipped with mobile ICTs [19]. In other words, we understand that mobile ICTs thus provide a *flexibility of geographical (spatial) movements*, and workers equipped with such mobile ICTs tend to accomplish tasks irrespective of their geographical location.

Mobility can also be characterized as temporal. Temporal mobility refers to the changes (mobility) in the various temporal structures of tasks such as “sequence, duration, temporal location, and rates of recurrence” [50, p. 3]. A good example of temporal mobility would be the case of a British traffic officer documented by Sorensen and Pica [115]. In this case, due to the inherent nature of their work (which involves stopping unlicensed, disqualified, dangerous and intoxicated drivers, checking for stolen vehicles, and attending accidents), the sequence,

² As the reader will observe, we draw upon the work of Cousins and Robey [22], who discuss the different affordances provided by mobile ICTs. Therefore, our notion of affordances is consistent with their work, where they define affordances “as action possibilities emerging from the relationship between actors and technology” [22, p. 35]. Notably, this is a relational view of affordances, which Robey and colleagues also discuss in their other works [2]. In this case, the affordances capture the relationship “between users’ abilities and features of mobile technology” [22, p. 34]. The relational perspective is useful, as indicated by its wider acceptance in emerging IS literature. For example, according to Treem and Leonardi, “the most nuanced writings on the relationship between technology and organizational change emphasize the relational character of affordances” [120, p. 146].

The advantage of defining affordances as relationships is that with change in features of technologies, there is no need to develop/conceptualize new affordances; concepts of existing affordances would still capture how those new features relate to people who use them [22].

duration, temporal location, and recurrence rates of the activities (of the officers) are not clearly defined. Accordingly, they rely on an assortment of mobile ICTs to support their work, allowing them to interact with other traffic officers and supervisors, the ambulance service, hospitals and undertakers, and control room personnel.

Finally, mobile ICTs provide contextual mobility. Contextual mobility is the “extent to which” mobile virtual workers need to “continuously reframe their interactions while performing their daily activities” [19, p. 622]. Contextual mobility necessarily affects the way in which various activities are handled [19]. For example, in the British police officer case discussed earlier [115], the officer might provide some important information to the control room, while chasing a speeding vehicle. Similarly, a physician may want to check a hospital patient's medical records in order to prescribe some new medication to the patient, while having dinner with family and friends at a restaurant [19]. Such situations reflect high contextual mobility, where the individuals need to perform different aspects of their professional responsibilities (e.g., the police officer), or perform their professional responsibilities while also fulfilling their social responsibilities (e.g., the physician).

Connectedness

Mobile ICTs, according to Perry et al. [92], enable the concept of access (thus participation), anytime and anywhere. This enabling aspect of mobile ICTs is termed as the affordance of connectedness by mobile ICTs [22]. This affordance of mobile ICTs supports both synchronous and asynchronous communications [63]. For example, a mobile worker could receive short message services (SMSs) regarding airline flight schedule changes or stock price alerts [108] or carry out actual conversations and corresponding coordination in real time among mobile workers.

In a work scenario enabled by mobile ICTs, communication is synchronous or asynchronous, and interaction patterns unpredictable and spontaneous [66]. In such a scenario, the ability of the mobile ICTs to ensure participation across spatial, temporal, and contextual differences enables both these modes of synchronous and asynchronous communication. For example, a mobile worker could receive and answer a phone call on a mobile device (completely synchronous) or receive an email on a mobile phone (slightly more asynchronous). It is important to note that often mobile technologies afford resources (e.g., information) to be shared and accessed in a both synchronous and more asynchronous manner [97].

Identifiability

Mobile ICTs provide identifiability, especially in a workspace that is dynamic [23]. While one might argue that such a dynamic work environment, coupled with the obvious virtualness of the environment, gives rise to serious considerations of identification [20], researchers have contended that mobile ICTs can be sufficiently advanced to counter this threat, at least to a reasonable extent [22].

In fact, as noted by Mahatanankoon et al. [68], mobile devices usually provide high levels of identifiability compared to desktops due to the existence of built-in ids. Furthermore, one can employ many strategies to enhance security on one's mobile devices, for example, using a password-protected mobile device [37]). Supporting this argument, Liang and Wei [63] categorically state that mobile devices include capabilities of identifying users. As they argue, based on Varshney and Vetter [125], this capability allows users of mobile banking and brokerage services to conduct financial transactions. Liang and Wei [63] further discuss the case of Nordea Bank and Nokia, where mobile users had smart cards embedded within their mobile devices in order to conduct financial transactions.

Interoperability

Interoperability is defined as the “potential to use mobile technology to share information, data and resources across various heterogeneous devices and applications” [22, p. 46]. For example, in a study of mobile ICTs for education, Zhang et al. [141] note how these technologies enabled students to share information and learning. Among knowledge professionals at present, mobile ICTs allow sharing of information among such professionals, leading to increased work efficacy [76]. Such interoperability allows mobile users to create a “shared context in which knowledge is created, shared and utilized by those who interact and communicate there” [129, p. 121].

According to Koroma et al. [59], such an affordance allows mobile workers, supervisors, and organizations to come to a mutual understanding for problem solving. In particular, Picoto et al. [96] used the term “unison” to describe the access, integration, and sharing of data across and via multiple mobile ICTs, such as downloading data from centralized organizational ERP systems, synchronizing phonebooks and calendars, as well as viewing transactional updates. The ability to share information allows interpretation and sensemaking, and integrates mobile workers to the institutional logic by building trust and reflexivity [104].

Personalization

Personalization is defined as “the potential to select mobile technology options and settings to match user’s personal preferences or needs” [22, p. 46]. There is substantial consensus that links personalization to mobile devices, which are often referred to as companion devices. As previous research notes, such devices are intimately attached to the users, and are highly personal, often referred to as a companion devices [8]. As Campbell and Kwak [15] summarize, such mobile devices lead to an increased sense of personalization.

On a similar note, while discussing the phenomenon of m-learning using mobile handheld devices, Liaw et al. [64] note that one of main abilities of such handheld technologies is personalization. To prove their point, they refer to existing studies showing how such mobile devices afford personalized knowledge awareness [30]. This discussion shows the increasing personalization that mobile devices provide.

Mobile cases from the literature

The mobile cases presented here support the concepts developed in our literature review, and we later leverage both to develop our propositions. We present mobile cases to ground the theoretical concepts discussed in the literature review in empirical reality and thereby strengthen/support them. It is worth noting that the cases have been selected with the idea of theoretical sampling in mind, such that the underlying concepts can be easily located, argued for, and justified.³⁴ Each of these cases illustrates one or more of the affordances and the fluidity dimensions. The affordances discussed in the cases are based on our discussion on the mobile ICT affordances. Further details, capturing technological and organizational features that are at the root of these affordances, can be found in the *Appendix*.

It is also worth noting that the aim of the cases is not to provide empirical data but rather to support our logic in the theory development. We noted these affordances to highlight that the

³ We note that our goal is not to provide a comprehensive inventory of concepts but to identify and elaborate, in an exploratory fashion, interesting concepts associated with “real” mobile virtual work scenarios. To this end, we have located a number of cases as part of our ongoing work. We discuss three that are particularly rich in terms of concepts.

⁴ According to Rowe [103], one form of literature review is aimed to serve as a basis for developing a conceptual framework, specifically developing testable hypotheses. It is clear that we also attempt the same in our paper. Of course, there could be other kinds of literature review, where the existing research is treated as secondary data, and used to test hypotheses [19]. However, in our context, that is not the case. Rather, we use existing literature, including the cases to build, support, and elaborate the logic of our arguments. This approach is not only different from using literature to test hypotheses but also “in contrast to a grounded theory approach, [where]... theorizing is not based on previous empirical research of the strictly defined phenomena” [103, p. 245].

theory and logic behind the discussion of our mobile ICT affordances were based on real scenarios in mobile work and not merely hypothetical.

Case 1: Mobile Consultants [60]

This case is drawn from the recently published article by Leclercq-Vandelannoitte et al [60]. This case discusses a consulting organization called Bankco, where professionals were mobile and worked at client sites outside the office, using mobile ICTs for their tasks (highlighting the affordance of mobility). The mobile consultants reported to the project manager who could also be mobile, but who managed and coordinated the entire team, including the flexible work schedules/patterns of the team members (displaying task fluidity).

To support their work, consultants used advanced mobile devices, including smartphones, to perform their everyday work. Their work required them to be able to connect to their organizational network from anywhere (affordance of connectedness). The organization had its own server supporting the client databases, a customer relationship management (CRM) system, and, most notably, productivity tools that enabled sharing of files and information (affordance of interoperability). These centralized systems could be accessed using the professionals' mobile ICTs from any place; they use such mobile ICTs, among others, to track and follow up with clients (affordance of identifiability). Specifically, the mobile IS constituting the mobile devices as well as the centralized systems allow sharing of information and a "transparent" workplace (identifiability), where organizational resources can be accessed/shared (interoperability) as the professionals move between locations (mobility).

Case 2: Cablink in Singapore [41]

The case discusses the Comfort-Delgro Transportation in Singapore, which uses a system called Cablink. Cablink uses an automatic cab delivery facility that integrates Global Positioning System (GPS) with an interactive voice response (IVR) system. In typical circumstances, a

commuter calls Comfort's dispatch center or the automated system with the location and destination address. Cablink uses that information to automatically find the closest taxi and contact it via the Mobile Data Terminal (MDT) installed in the cab (affordance of connectedness for the ability to locate the taxi, as well as the affordance of mobility provided by the MDT). Then, the automated system accesses the database for the latest booking record (affordance of interoperability). If there is a match between the address and the customer's pick-up area, immediate confirmation can be made by the customer, who is then intimated on the vehicle information and the time of arrival. In case of emergencies, the MDT can locate nearby vehicles for assigning to the customer on an emergency basis (connectedness).

If no taxis are available in the nearby area, Cablink tries to manually locate taxis within a 2-km radius. The taxi drivers can bid on the arrival times and the one who bids the shortest arrival time wins the bid. The drivers may choose to reject this assignment; if they confirm, however, they are obligated to pick up the customer (this is control fluidity, where taxis can be reached, but they can also refuse). There are penalties for violating promises, which include shutting down of the MDT in the taxi for a specified time depending on the frequency of violations. Overall, CabLink enabled accuracy and efficiency, and was greatly accepted by the Singapore public.

Case 3: The Life of a British Traffic Officer [115]

The third case that we discuss concerns the life of a British traffic officer, as documented by Sorensen and Pica [115]. Traffic officers in this case perform a multitude of tasks. The tasks range from stopping unlicensed, disqualified, dangerous, and intoxicated drivers; checking for stolen vehicles; and attending accidents and fatal and serious injuries. Apart from that, they also streamline, facilitate, and ensure smooth flow of traffic.

Their work involves traveling in their vehicle 65% of the time. The officers are very mobile, traveling considerably and covering an area of up to 200 square miles. Due to their mobility, they are always armed with mobile devices (affordance of mobility) so as to interact with other traffic officers and supervisors, ambulance service, hospitals and undertakers, control room controllers, victims, offenders, and witnesses (affordance of interoperability). However, due to the uncertain and unanticipated nature of their work (task fluidity), they do not know the individuals they would be interacting with beforehand. In their work, they use mobile technologies including MDT, KB radio, and mobile phones. Throughout the duration of their work, the mobile police officers are in close contact with the control room as a centralized information resource (affordance of connectedness). The control room plays a vital role in the work of a traffic officer, who in turn works closely with control room professionals in time-critical policing operations. Often police officers attending a specific event (e.g., an accident case) may be reassigned to another case (such as searching for a court witness), thereby replacing other police officers, who may in turn be reassigned elsewhere (team fluidity).

Theory Development

Building upon the literature review, and a review of the published cases, we present our conceptual model linking mobile ICT affordances to organizational fluidity (Fig. 1). It should be noted that not all affordances affect all dimensions of fluidity. Specifically, we contend that a combination of specific affordances acts as a causal antecedent to each fluidity dimension.

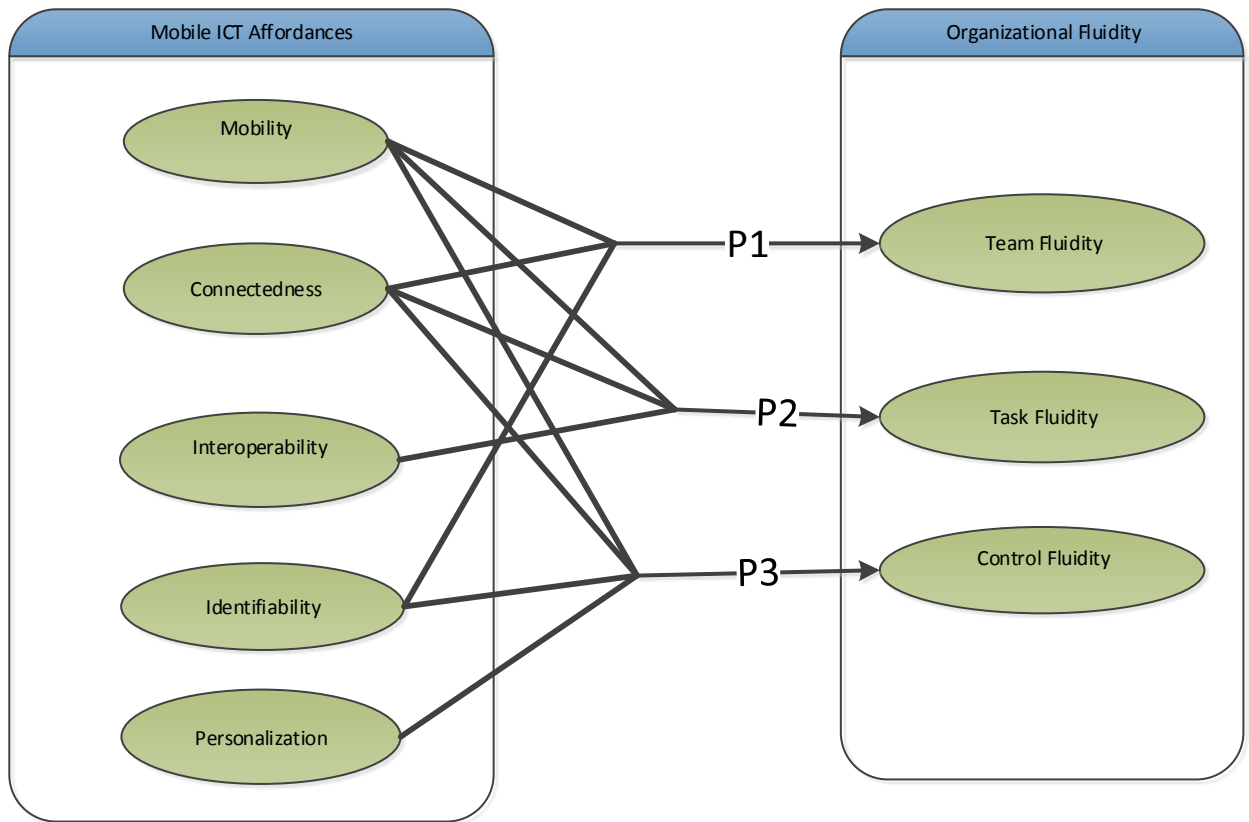


Figure 1. Influence of mobile ICT affordances on Organizational Fluidity

Antecedents to Team Fluidity: Mobility, Connectedness, and Identifiability

Our basic contention is that a combination of three mobile ICT affordances – mobility, connectedness, and identifiability – contributes fundamentally to team fluidity. Fluid teams are defined as those where “highly skilled members cooperate to perform urgent, unpredictable, interdependent, and highly consequential tasks while simultaneously coping with frequent changes in team composition and training their teams’ novice members” [57, p. 590]. Increasingly, such teams are geographically dispersed and use advanced ICTs to communicate and coordinate action [28]. Given the dynamism in current business activities, team fluidity is a frequently occurring phenomenon [74].

In such teams, typically memberships are ephemeral and the tasks they perform are extremely time sensitive – for example, firefighter and other emergency personnel teams, who often have not worked together as a team [57]. The fundamental aspect is that these fluid teams inherently rely upon the ability to draw resources and personnel independent of their spatial/temporal/contextual coordinates [28]. Therefore, the affordances of mobile ICTs, which allows individuals to be on the move (affordance of mobility), while also being always connected (affordance of connectedness), is crucial for engendering such fluidity.

The salience of these affordances is highlighted if we investigate the causes of team fluidity. Among others, two primary reasons are important, namely the requirement for different skills at different stages of the project, and the achievement of operational efficiency, subject to labor availability [14]. The availability of both labor and skills is contingent upon the ability of mobile devices to bolster mobility and connectedness. For example, consider case 3, and imagine a scenario of a traffic accident. The control room would probably delegate the geographically nearest available police officer to that accident. However, this is only possible because the mobile ICTs have allowed the officer to be near the area in the first place with all relevant information processing capabilities (affordance of mobility), as well as provided a means for the control room to contact the officer (affordance of connectedness). Once this officer reaches the area, other officers may also be called in, and the officer who arrived first may then leave to attend to another incident. This changes not only the team's composition (i.e., police officers being replaced) but also the structure (i.e., newer arriving police officers may assume more central roles in resolving the incident).

Another important aspect of such team fluidity is the concept of multiple team memberships, often enabled by the mobile ICT affordances. Mobile ICTs enable seamless

multitasking, which implies that individuals can work on two or more tasks simultaneously and switch between the tasks effortlessly [83]. Such multitasking enables organizations to be fluid in terms of who are called upon to attend to any particular task and when [117].

Finally, the affordance of identifiability further contributes to team fluidity. To theorize this relationship, we build upon the work of Cousins and Robey [22], who note that the affordance of identifiability enables two practices, namely self-presentation and distant mobile copresence. According to Cousins and Robey, self-presentation allows individuals to share their attributes with others (such as locations, knowledge, and connections to other individuals). Conversely, distant mobile copresence allows workers to engage in situations beyond their immediate physical environment. Thus, for example, with this practice, individuals at home can still be contacted for, and can engage in, office-related work.

Both these practices allow individuals to be identified for specific roles, allowing them to move in and out of teams. For example, e-mail via the mobile device facilitates team fluidity for this very reason [65]. Further, the practice of information sharing leads to implicit/unplanned coordination within teams, thus fostering team fluidity, where a team member can be brought in for a specific duration and task [14]. Thus, in technology-mediated environments (such as mobile environments), team fluidity is rapidly increasing [58].

Researchers have noted that mobile ICTs provide improvised interaction due to their ability to enable such ad hoc information sharing practices, thus breaking down boundaries such as team-level barriers. These ICTs also dynamically configure such people and artifact boundaries – such as adding or removing team members in an extemporaneous manner [112].

Arguably, therefore, mobile ICTs especially in their ability to provide access to human resources – due to the identifiability affordance – allow assembly and disassembly of people

called upon to work in projects on an ad hoc basis [131]. It follows then that identifiability can influence team fluidity, in conjunction with mobility and connectedness (which we established earlier). Therefore,

P1. Mobile ICT affordances of mobility, connectedness, and identifiability together positively enable team fluidity in organizations.

Antecedents to Task Fluidity: Connectedness, Interoperability, and Mobility

Three fundamental affordances of mobile ICTs – connectedness, interoperability, and mobility – play salient roles in enabling task fluidity. In this context, it is useful to understand that task fluidity entails performing tasks, often in an improvised manner, in unpredictable circumstances [57]. Fluid tasks are characterized by unpredictability in the sequence of steps, as well as how the tasks are defined and structured [130]. They also require flexibility in arranging work practices and coordination of those work practices [28]. In such “looser” contexts, teams often focus on how the tasks are dynamically handled [75]. In such task contexts, professionals must be able to “work fluidly, to...[work] at real-time speeds, advise, approve, inquire, develop relationships, co-ordinate, collaborate, communicate and problem-solve on a daily basis.” [114, p. 190]. Typically, such fluid work arrangements, unless ably supported, such as by mobile ICT affordances may cause structural turbulences and uneasiness [53].

We discuss how the abovementioned affordances enable task fluidity. The affordance of connectedness allows professionals to attend to tasks on the move – for example, this affordance allows individuals to conduct urgent transactions and receive and process urgent information in between meetings and travel [110]. On this note, Govindaraju and Sward [33] point to the possibilities of time slicing using mobile devices, described by Sarker and Wells [105] as “filling” and “shifting” of time. Reinforcing this notion, Nah et al. [82] also note that using

mobile ICTs provide the flexibility for users to be “connected” to their organization and engage in business-related activities while performing daily activity patterns. Middleton and Cuckier [79], in reporting the findings of their research study on mobile email users, note that the users acknowledged that their mobile devices allowed them to multitask because it enabled them to “work from anywhere” (p. 252).

These ideas are evident in our cases presented. In case 1, due to the connected nature of the mobile consultants, they could contact their colleagues (e.g., to seek help on a specific client project) while mobile [60]. Due to this, the *connected* mobile agents need to rapidly adapt (and readapt) themselves to accommodate the different types of tasks they may need to accomplish during any given time period. As a case in point, the participants could be driving to a client site while responding to the manager with an update on a different client. In case 2, the cabbies could be dropping off a passenger while receiving instructions on the next pick-up. In case 3, the mobile traffic officer could be watching the traffic while s/he might be called in to provide information to another *connected* mobile traffic inspector involved in a car chase. All of these possibilities imply that the mobile users could work in “short instantaneous bursts” where tasks are ephemeral [48] – essential to the idea of task fluidity.

However, without the interoperability affordance, this connectedness affordance will be rendered inconsequential. For example, in each of these three cases, mobile ICTs enable sharing of information among the mobile workers. For example, in case 3, the police officers pass information to the control room, which then shares it with other traffic officers. In case 2, the Cablink system allows information to be exchanged among taxi drivers equipped with MDTs and the central dispatch system.

In a work scenario, where agents are not collocated, interaction patterns unpredictable and spontaneous, and the nature of the work ephemeral, the access and sharing of resources becomes a key issue in developing the fluidity of task performance [10]. An example of this affordance can be observed in the work of Kumar et al. (2007), who describe a prototype for mobile devices used in m-commerce. Their prototype concerns a three-tier client server architecture consisting of a data warehouse, a middle-tier server, and client mobile devices. The interoperability affordance is provided through a centralized resource (the data warehouse) that is ultimately connected to a noncentralized resource (the personal mobile device) through the middle tier.

It can be inferred that such an affordance encapsulates *an ever-adaptive synchronization between different individuals* with respect to information and data sharing for achieving effective peer-to-peer, individual-to-team, and team-to-individual resource sharing. For example, Pilioura et al. [97] argue as to how Web Services could achieve such synchronization through activities such as publish, update, invoke, and bind (that occur between Web Services components).

The overall idea that emerges is that a combination of *the two affordances of connectedness and interoperability enable fluid, unstructured work in variable task contexts* [89, 138], where information processing is less formalized and requires a high degree of improvisation. *Consequently, tasks performed in such contexts may be characterized as “collaboration on demand,”* linking it to the idea of collaboration (ever)-readiness [85]. Obviously, such on-demand, unplanned work can be handled because of the affordances of connectedness and interoperability [23, 51], which allows mobile workers to be reached at any time, as well as allows them to work at any time/place/context.

Such affordances enable all the task components to be properly coordinated (through connectedness) and executed (due to interoperability) for a meaningful task output. These notions actually point to an extant view of agile workflows that can respond dynamically to business processing needs [61]. In sum, enabled by the affordances of connectedness and interoperability, organizations can engage with a distinct flexibility (“agility”) in the structuring of work. In support of this, Kakihara [49] observes that “mobile professionals reconstruct organizational settings and boundaries through their fluid work practices, largely supported by their active utilization of ICTs” (p. 194).

It is evident that task fluidity increases through a combination of connectedness and interoperability. However, this task fluidity is *further boosted* due to the mobility affordance of mobile ICTs. To theorize about this relationship, we observe the effect of mobility on predefined task structures such as venue, time, and the nature and agenda of work. Due to human mobility, the workflow is managed, not through such prestructuring, but rather by *flexible un-structuring* through fragmentation and re-coordination [18] and by collaboration on demand (as noted above). Because mobile work occurs in situations where the interacting individuals do not meet and yet their collaborative inputs can to be combined into a harmonious whole, this mode of work involves both fragmentation and re-coordination – an inherently fluid phenomenon.

Further arguments connect to the strong role of mobility in promoting task fluidity. First, the mobility affordance allows individuals to work anytime and anywhere [3]. Specifically, due to the ability to disperse work across location, time, and space, the sequential and structured nature of work is often absent. One of our cases lends support to this argument. For example, in the case of a British traffic officer documented by Sørensen and Pica [115], due to the inherent nature of his or her work (which involves stopping unlicensed, disqualified, dangerous, and

intoxicated drivers; checking for stolen vehicles; and attending accidents), the sequence, duration, temporal location, and recurrence rates of their activities are not clearly defined. In other words, their tasks are fluid, and in order to engage with these fluid tasks, they rely on an assortment of mobile devices – affording them the freedom to be mobile – to better support their fluid work. We can thus argue that in such a situation, with the need to engage in ad hoc, unanticipated, and thus temporally unstructured work (task fluidity), the mobility afforded by their work devices enables them to engage meaningfully in such activities. It is notable that the affordance of mobility allows workers to be loosely coupled to each other, in essence promoting autonomous and on-demand collaboration [84], which we have already alluded to.

Finally, we note that the affordance of mobility satisfies the compulsion for proximity in human beings [18]. In a professional work context, which demands frequent reordering of schedules and coordination, (mobile) technology-mediated connectivity becomes critical [23], creating a perpetual presence for such mobile workers as they can be reached anytime, anywhere, and in any context [18]. In other words, not only does mobility afford task fluidity but task fluidity also “demands” such mobility.

Therefore, it can be logically inferred that the affordance of mobility enables task fluidity, in conjunction with connectedness and interoperability. Hence,

P2. Mobile ICT affordances of connectedness, interoperability, and mobility together positively enable task fluidity in organizations.

Antecedents to Control Fluidity: Mobility, Connectedness, Identifiability, and Personalization

In this subsection, we address the tension between flexibility and control when enabled by mobile ICTs, specifically through the affordances of mobility, connectedness, and

identifiability. Our central assertion is that these affordances taken together enable organizational loose coupling [9], while also embodying elements of hierarchical control [87].

First, we discuss the affordance of mobility provided by mobile ICTs. As argued earlier, this affordance enables fluid organizing of work [49, p. 194]. Such “fluidity” is in contrast to the concept of organizational structure and control [135]. Issues of process control, such as spatial/temporal/contextual scheduling of work, allocation of work, distribution of work, patterning of work, and structuring of work, are often not considered strictly within the context of mobile virtual work, especially due to the mobility provided by mobile ICTs [118].

The affordance of mobility can support unstructured, nonrepetitive work, which inhibits the establishment of a predefined task distribution, and thus the organizational control that characterizes such predefined task distributions [7]. To present our argument, we build upon the arguments of Wiesenfeld et al. [135] and contend that mobile ICTs that allow individuals “the freedom to work anytime and anywhere” (p. 777) – the affordance of mobility [69] – also mitigate the ties of control that exist between the organization and its employees. As Middleton et al. [77, p. 506] note, always being connected while being mobile affords the mobile users the “*control* of situations...as to how, when, and where they engage in their...roles” [emphasis added].

However, the case of mobile ICTs is often paradoxical [4]. For example, Cousins and Robey [23] note that mobile workers are susceptible to unrestricted access – due to the *connectedness* affordance provided by such mobile ICTs – thus possibly being subjects of control. Furthermore, previous research [4] argues that a mobile user carrying a mobile device must always be ready to answer the call because of the flexibility provided. As literature has

argued, the connectedness provided by mobile ICTs leaves employees “feeling bound to work” [54].

As Jarvenpaa and Lang [46] argue, the *connectedness* afforded by mobile ICTs as instruments of control has led to individuals being coupled tightly to work contexts. As they note, their study participants frequently reported “increased work pressure, closer monitoring and supervision, and the inability to separate and keep distance from work” (p. 11). In fact, one of their study participants mentioned that s/he could not turn off his/her mobile device as his/her supervisor did not want it so, showcasing how mobile workers are subject to organizational control. For example, a mobile team member can be reached by the team leader “on demand” at times and places even outside the scope of normal organizational activity (e.g., in the middle of the night or even when the employee is on vacation). This creates a sense of “control.” This notion is supported by case 3, where the mobile police officers (an example of a mobile workforce) are strongly connected to the “control” [emphasis added] room during the course of their mobile work. Case 1 supports this concept as well, where the mobile professionals were always under the purview of the team manager [60].

Another affordance of mobile ICTs, namely *identifiability*, supports this increased control. Liang and Wei [63] categorically state that mobile ICTs include abilities to *identify* users, thus increasing organizational control. Mobile ICTs inherently provide monitoring capabilities [63, 124], due to the existence of built-in identification mechanisms [68]. The identifiability afforded by mobile ICTs enabled digital traceability [67].

An excellent example of how mobile ICTs implement organizational control through the affordance of identifiability, Sørensen’s [111] describes “an organizational system with RFID-enabled mobile phones that recorded RFID tags and automatically sent SMS messages with the

readings to a central server enabled coordination of the work force in two different organizations” (p. 283). Note that radiofrequency identification (RFID) is an identifying technology, and Sørensen [111, p. 283] p. 283) goes on to note the resentment arising from the *control* of this mobile system:

“...the workers found this particular type of mediated coordination problematic as they were used to having considerable discretion [emphasis added] in the organization of work. Now they had to check with central management [a controlling authority], which felt it had a good overview remotely through the information fed by the RFID-based system...”

We can therefore conclude that mobile ICTs – through the affordances of mobility and connectedness – enable individuality and freedom while supporting virtual work (e.g., the ability to do office work while travelling), and they also make it possible (through the affordances of connectedness and identifiability) to exercise perpetual organizational monitoring and control. As aptly summarized by Tilson et al. [119] drawing upon Sørensen [111], “mobile ICTs possess the paradoxical possibilities of both tighter and looser organizational control...” (p. 754, emphases added). In other words, such dialectic and paradoxical considerations in any work process can be best accommodated by mobile ICTs that enable both organizational loose coupling (e.g., freedom and worker discretion) and tight coupling (e.g., control and monitoring).

Summarizing the relation between the mobile ICT affordances (such as mobility, connectedness, and identifiability) and fluidity of control, Leclercq-Vandelannoitte et al. [60] note that mobile ICTs

“offer both more freedom and increased servitude.... Although mobile IS may be engaged in ways that promote flexible, responsive, dynamic organisations and non-bureaucratic control systems, they also might be used as tools that reinforce control, availability demands, and employee traceability.” (p. 547)

The dialectic between enforcement and relaxation of control is further evidenced upon investigating another key mobile ICT affordance, *personalization*. This affordance is particularly interesting because while other affordances (such as connectedness and identifiability) allow mobile workers to be reached and engaged at any place/time (i.e., be controlled), personalization allows the users to exercise their control preferences. In essence, personalization allows others to adapt to the mobile users' style of working and other needs, both emotional and functional [1]. Furthermore, it allows mobile users to receive information in the way they want [121], thus helping them plan better on how to execute tasks in their professional and personal lives [22]. In general, it makes users receptive to information that they receive [136], as well as being selective in how they respond to that information [16]. Therefore, it can be safely argued that this affordance allows individual freedom from control.

In other words, personalization, similar to mobility, allows individual freedom, thus loosening the control that connectedness and identifiability impose – this ensures the control fluidity. For example, connectedness and identifiability allow the organization to exert control on the user, whereas mobility (as discussed earlier) and personalization provide a conduit for the expression of individual's preferences, loosening that control to an extent. In addition, the increased personalization often fosters increased trust [15], which, arguably, lessens the relevance of control, thus fostering control fluidity.

In fact, while appropriating the mobile ICTs as tools of autonomy to work anytime/anywhere, individuals ultimately ended up using it everywhere/all the time, thus diminishing their autonomy in practice" [76, p. 1337]. Leclercq-Vandelannoitte et al. [60] liken this to the notion of "free control" where control is distributed, voluntary, and interactive – thus fluid. Essentially control is fluid because connectedness and identifiability reinforce it, whereas

mobility and personalization provides some freedom from this control. We contend that this simultaneous freedom and control embodies the fluidity, especially enabled by these affordances.

Therefore,

P3. Mobile ICT affordances of mobility as well as connectedness, and identifiability as well as personalization, positively enable control fluidity in organizations.

Contribution and Future Implications

Contribution

Our paper makes a theoretical contribution to the literature on mobile ICTs and organizational fluidity. As a theoretical paper, it adheres to the standards established by Whetten [133], in delivering new theories relevant to both academic and practitioners. Notably, this is an example of a cross-level theory that describes “the relationship between independent and dependent variables at different levels” [102, p. 20]. The mobile ICT affordances are mostly at the individual level, whereas fluidity is at the organizational level.

This cross-level theorizing is valuable.⁵ In organizational research, cross-level theorizing is in great demand, with some arguing “that cross-level...effects are so central to an understanding of organizational phenomena that they should be distinctive features of organizational scholarship...” – often, a focus of such cross-level analyses has been how organizational properties emerge from activities occurring at the lower (e.g., individual/team) levels of analyses [134, p. 541]. While the focus of such theories is often apparently individuals,

• ⁵ There are many examples of cross-level theories in organizational as well as IS research [62]. For example, Drazin et al. [25] engage in cross-level theorizing about creativity in organizations. Again, the social capital literature often engages in cross-level theories where the dependent and independent variables are at different levels [91]. Again, in IS, Bock et al. [11] not only include both individual- and community-level variables in their study of virtual communities but also study their interaction.

they are actually individuals embedded in an organizational context [56]. In this context, it is useful to note that regardless of how we define IT affordances, they basically refer to what IT allows users to do in an organizational context [72, 140]. The IS discipline has increasingly considered cross-level/ multilevel theories. Notably, one of the “highly valued characteristics” in *MIS Quarterly Theory and Review* include “multilevel theory” [71, p. v]

These arguments highlight the value of our study by engaging in a cross-level study. In fact, recently, Robey et al. [101] have argued for such cross-level engagement with respect to affordances. They argue that while affordances primarily emphasize “the relationship between a single actor and specific material objects,...to be useful in explaining organizational change, the affordances that material artifacts offer...they must “scale up” to describe the relationship between aggregated technologies and larger social collectives (e.g., organizations) (p. 391). In their view, the concept of affordance proposed by Zammuto et al. [140] (which we draw upon) increases the scale and scope of such affordances, without which “the concept of affordance may remain explanatory at the individual level of analysis only” (p. 392).

In developing the cross-level theory, the paper makes two other important contributions to the existing literature. First, it seeks to reveal the association between mobile ICT affordances and organizational fluidity. Our work was motivated by the belief that a deeper understanding of this phenomenon can help promote effective mobile work among individuals, groups, businesses, and the society as a whole. Our work highlights the richness, multidimensionality, and often fluid nature of work using mobile ICTs, ultimately leading to organizational fluidity, which can be leveraged by organizations to be more responsive to high-velocity changes in the business landscape. Noting that organizational fluidity is an under-researched topic, and the call for

understanding newer implications of mobile ICTs to organizations, this paper potentially makes an important contribution to the literature.

The second important contribution of this paper comes within the purview of designing fluid organizations using mobile ICTs. This paper, by delineating key antecedents of organizational fluidity, provides the “justificatory theoretical knowledge” [35, p. 628] that can be used in the design and development of fluid organizations, as well as mobile information systems that enable such organizational fluidity. The concepts presented here can be considered when designing such technologies and processes. For example, the notion of the paradoxical coexistence of both tight control and flexibility in work enabled by mobile ICTs can be considered by organizations for designing and implementing mobile technologies and organizing the mobile workforce.

Implications for research

Two major implications for future research emerge from this paper. First, the theoretical framework presented here could give rise to multiple empirical studies for empirically examining whether (or not) the key antecedents presented in this paper actually enable organizational fluidity. As an example, a study could conduct a survey of mobile professionals and empirically examine whether the affordances presented here actually lead to the respective dimensions of organizational fluidity. An ethnographic study could also be conducted for the same purpose.

Second, the concepts presented here can enable future research on design principles for mobile ICTs supporting mobile work, and the design of the processes (e.g., facilitation, multitasking, etc.) necessary for organizational fluidity. The concepts presented in this paper (e.g., task fluidity) can be a starting point for designing processes that capture such fluidity, by properly appropriating the mobile ICTs.

Implications for practice

As argued previously, the concepts presented in this paper have potential implications for design, thus informing practice. First, this paper provides important implications for enabling fluid organizations. The paper suggests characteristics of mobile ICTs that may be well suited for this purpose. Concepts such as task fluidity, supported by mobile ICTs, can help organizations determine which types of work can be achieved best using a mobile workforce. Thus, we can understand the practical issue of actual mobile ICT adoption by the workforce. If contemporary organizations need to design their activities, in terms of appropriate (fluid) control, tasks, and teams, then this paper provides a blueprint of what ICTs they should use and how they should be appropriated, so that the corresponding affordances are leveraged.

In addition, this paper highlights the implications of mobile ICTs and their affordances, thus providing useful inputs for technological design. Such considerations emphasize generic design principles for mobile ICTs, such as a potential for continuously available information to support the affordance of connectedness [116]. Such affordances of mobile ICTs would enable mobile devices to fit the human environment seamlessly, rather than force-fitting individuals into an artificial world of computers and technologies [132]. Again, the affordance of interoperability is key to leveraging the benefits of mobile ICTs. In order to implement this affordance, mobile ICTs should likely be designed keeping in mind a centralized repository, as well as tools that enable seamless sharing of data across mobile devices (as is case 1). Furthermore, the affordance of identifiability points to useful considerations in mobile ICT design, such as designing and sharing unique ringtones and secure digital keys and certificates. Finally, the affordance of mobility inherently points to the need for better coverage of primary mobile service provider networks, to reduce roaming costs and thus facilitate greater mobility. To conclude, the

implications of mobile ICTs must be explored further, particularly in how they create newer, dynamic, and flexible organizational forms. We are hopeful that this work, which synthesizes diverse ideas from the literature, can contribute positively to the ongoing conversations on this very relevant topic.

Appendix: Technological and Organizational Features Contributing to the Affordances in the Three Cases

Case 1. Bankco

Technological Infrastructure

- Wi-Fi laptops
- Sophisticated mobile and smartphones
- Company server which included client database, CRM, and productivity tools (e-mails, shared agendas, scheduling); shared knowledge repository and applications for reporting and billing

Organizational features/needs

- Need to access information at a distance
- Keep track of client visits and follow-up visits
- Transparency
- Peer collaboration on demand

Case 2. Sensitive Cabbies

Technological Infrastructure

- Interactive voice response and GPS
- Text to voice automated phone system
- Hot spots
- Centralized database
- Mobile Data Terminal ()
- Cablink's satellite system

Organizational features/needs

- Nomadic movement around city to maximize exposure
- Accurate vehicle tracking
- Booking confirmation
- Cabs assigned on geographical proximity and first-come-first-served basis
- Moving beyond geographical boundaries to expand business opportunities. These included commercial and shopping hubs, office-time pickups, and late-night crowds from entertainment spots.
- Centralized supervision of cabs
- Finding the "zero point" of the callers' location

Case 3. The Life of a British Traffic Officer

Technological Infrastructure

- Police Car MDT (mobile data terminal)
- Personal Radio (PR)
- Mobile Phones
- KB Radio

Organizational Features/Needs

- Being better informed
- Coordination with control room as well as
- Coping with uncertainty
- Time Criticality
- Proactive as well as reactive policing

Biography

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