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Implementation of weakly structured systems: moving from local practices to common organizational rules

Completed Research Paper

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Abstract

The traditional implementation of an information system assumes that the IT system to be implemented is highly structured (HSS), carrying out regulatory functions expressed in organizational rules scripted into the system. Subsequent implementation seeks users' compliance with stated regulatory needs. We propose an alternative view of implementing IT systems when such systems are weakly structured (WSS). In these systems, most scripted rules express the composition and behavior of digital objects, which organizational members tend to voluntarily enact as part of their tasks. By using analytical inference and illustrative examples, this work extends the Trifecta model of organizational regulation by developing a vocabulary and a process model for the evolution of the rule system during the implementation of WSS. The offered model depicts IT implementation as a movement from local practices, where system uses are discovered as affordances, to wider rule sets that regulate and enforce the shared deployment of such affordances.

Keywords: IT implementation, weakly structured systems, WSS, trifecta model of organizational regulation, process model, evolution of rule system.

Introduction

Implementation is about episodic introduction of information technology (IT) systems that makes them fit the organization's *modus operandi* (Cooper & Zmud, 1990; Leonard-Barton, 1988; Lyytinen & Newman, 2008). Recent analyses of technology-mediated organizational change have advanced multiple competing explanations of implementation and its outcomes calling for more detailed analysis of the role of technology during the implementation process (Volkoff et al., 2007). Traditionally, information technology (IT) implementation has been portrayed as a sequence of stages, viewed as instrumental in putting in place *ex ante* known system functions and in ensuring that users' behaviors will be aligned with those dictated by the system (Berente et al., 2016; Cooper & Zmud, 1990; Lyytinen, 1987). This perspective treats implemented IS as to convey organizational rules governing how activities, such as payroll, ordering, or hiring, should be defined, structured, and connected. We call systems embedding families of such rules

highly structured systems (HSS) – most notably systems like ERP- because they structure and glue together organizations’ activities by conveying rules. The systems as such enable efficiency in conducting activities in an expected way and provide for organizations’ control over them. Generally, implementation of HSSs ‘moves’ the centrally- and *ex ante*-defined rules devised and agreed by central authority to local practices (de Vaujany et al., 2018; Reynaud, 1988).

Today many commonly used ISs in organizations differ significantly from the purposes and functions of HSS. Applications such as e-mail, e-learning and knowledge management systems, and enterprise social media support voluntary, weakly- or non-structured organizational tasks encompassing spontaneous communications, knowledge sharing, learning, and so on (Alavi & Leidner, 2001; Neeley & Leonardi, 2018; Nonaka, 1994). These systems are becoming more common as robotics, AI-based learning systems, enterprise social media, and e-learning environments continue to penetrate the workplace. What are the functions of such systems and how they can be meaningfully implemented in organizational practices is often not known in *ex ante* – either by the implementers, or by the users. We call such systems *weakly structured systems* (WSS) because their use is not dependent or conditioned by centrally provided organizational rules. This is so neither initially nor during the course of their use. In consequence, implementing such systems do not call to restructure existing practices as to comply with rules embodied in the WSS. Rather, rules scripted in WSS typically enable discovery of affordances – “behaviors associated with achieving an immediate concrete outcome and arising from the relation between an object (e.g., an IT artifact) and a goal-oriented actor or actors” (Volkoff & Strong, 2013, p. 823) – that augment and expand focal practice resulting in unexpected tasks, new communications, and improvised interactions (Leonardi, 2007). Consequently, the regulatory process entangled with the WSS implementation ultimately can be viewed to establish rules regulating system use in ways unanticipated by WSS designers and implementers.

A well-established stream of research has investigated in the past how HSS are effectively implemented and how implementation expresses a movement from centralized rules to practices (Berente et al., 2016, 2019, 2019) thereby enabling that these systems can serve and promote exogenous regulation (de Vaujany et al., 2018; Gosain, 2004). In contrast, implementing a weakly structured system (WSS), as a movement from practices to newly discovered rules, has received less theoretical and empirical attention. This view would attend to how users and other stakeholders locally perform various system functions and thereby discover and enact individual-level affordances (Leonardi, 2013) which through implementation process become elevated to the group level shared activities (Burton-Jones & Gallivan, 2007) whereby they become expressed in organizational rules as *joint regulation* (that involving bottom-up and top-down regulatory initiatives) (de Vaujany et al., 2018; Reynaud, 1988). Yet, understanding the regulatory metamorphosis from the individual system use to the organizational level affordances has not been examined in detail and forms an critical step in theorizing WSS implementation as an organizational-level process (Burton-Jones & Gallivan, 2007). Such theorizing requires articulating how WSS implementation evolves organizationally by identifying, negotiating, maintaining, and enforcing WSS uses expressed in organizationally shared rules.

This study theorizes implementation of WSS as emergent organizational regulation where individually discovered affordances become expressed in shared and enforced rules as a joint regulation. Specifically, we 1) elaborate a theoretical framework and 2) related lexicon conducive for analyzing WSS implementation as joint regulation, as well as 3) identify mechanisms that transform during implementation individual uses of WSS (affordances) to collectively regulated WSS uses.

As issues related to managing and implementing WSSs in organizations grow, addressing theoretically how such implementations unfold and what mechanisms underlie them has become more salient in IS field. Of note is that these processes are different from and therefore call for different theorizing when compared to dominating HSS analyses.

IT implementation as a regulatory process

Traditionally, implementation of IT was seen as a way to enhance efficiency of and control over organizational processes (Venkatraman, 1994; Zuboff, 1988). Based on the premise that “control in organizations is achieved through what are termed ‘rules’” (Clegg, 1981, p. 545), over the past half century IT-based systems have emerged as a central means to materialize and enforce organizational rules. Organizational rules, in general, articulate what standardized or routinized activities mean, how they will

proceed, and to what ends. These rules embody normative statements about how an organization’s members should (or should not) behave in relation to task, object, goals, or setting (Mills & Murgatroyd, 1991, pp. 3–4). Formulated and materialized rules carry regulatory significance toward targeted practices and related organizing (Yates, 1993) and promote community-wide rulemaking and rule following in ways that expand and sharpen organizational control and its perception (de Vaujany et al., 2018). In this research, we understand rules as linguistic forms of expressing deontic content primarily related to IT use.

	Highly Structured System (HSS)	Weakly Structured System (WSS)
Metaphors to describe the implementation process	Freezing & compliance: Enforcing pre-defined, centrally formulated rules in local practices. The aim is to comply with centrally formulated rules during the execution of organizational tasks.	Exploration & bracketing: Discovery of scripts for system uses and their legitimation through bracketing of system features within the context and scope of work. The aim is to expand/ revise information flows associated with organizational tasks.
Nature of materialization	Organization’s guiding rules that define its core functions integrated into and coordinated with use of IT systems through inscription and by ensuring their enforcement through elicitations	How, when, by whom system functions are used treated as affordances, which are invented and later formulated as shared rules which expand and direct the system’s use collectively
Nature of implementation	From rules to practices Exogenous regulation Staged implementation, from unfreezing (loosen current rules) to refreezing (compliance with new rules) Group of stakeholders involved in during phase, distinguishing (practice) insiders from outsiders	From practices to rules Joint regulation Continuous, expansive and evolving regulation of local system uses Fluid and unstable group of stakeholders, making a separation of inside and outside of the practice challenging
Examples of materialization and rules	Rules for intermediated procurement Rules for procurement approval Rules for project budget management Rules for project fund allocation	Rules for the use of digital objects Systems functions to display and relate local information Rules for disseminating information among local user groups
System examples	Enterprise resource planning (ERP) systems Customer relationship management (CRM) systems Electronic health record (EHR) systems, Business process management (BPM) systems	E-mail E-learning systems Knowledge management systems and repositories Operations support system (OSS) tools and coordination systems
References	(Berente et al., 2016, 2019; Boudreau & Robey, 2005; Dumas et al., 2018; Volkoff et al., 2007; Volkoff & Strong, 2013, 2017)	(Barley, 2015; da Cunha & Orlikowski, 2008; Denyer et al., 2011; Gal et al., 2014; Malhotra et al., 2021)

Table 1. Highly and Weakly Structured IT Systems as regulatory processes

Traditionally, the organizational bureaucracy, governments, and professional bodies were seen as one source of rules in organization, which “must and do claim authority over the individual, independently of the subjective meanings he may attach to any particular situation” (Berger & Luckmann, 1966, p. 62). Another source of rules are individual members as they possess the varying “degree of autonomy, discretion, and freedom from direction” with regard to the organizational control (Clegg, 1981, p. 545). Similar to this dualistic source of rules, rule-enforcing mechanism in organizations can be embedded both “in the physical

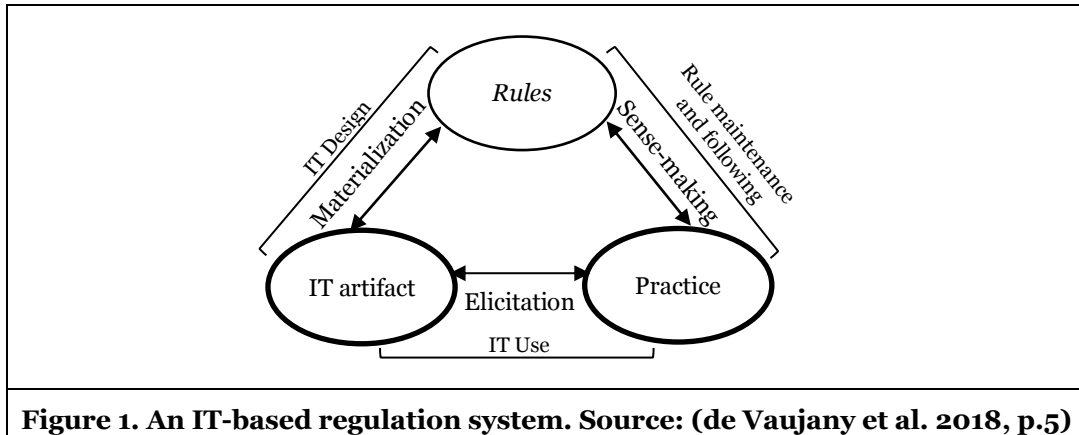
technology of the firm”, and “in the social organization of the enterprise” (Clegg, 1981, p. 550). Given the unprecedented capacities of IT to share, enforce, and coordinate rules, IT systems now serve as an overarching and potent mechanism for organizational regulation which we refer here as collective processes of rulemaking, rule maintenance, rule following, and rule enforcement, achieved through negotiation, configuration and mobilization of various resources (Hage & Aikien, 1969; Leblebici & Salancik, 1982; Reynaud, 1988, 1997; Suddaby et al., 2007). By trying to make rules acceptable and legitimate, “actors contribute to the emergence and transformations of rules, to the regulation which is grounded into actors’ interactions.” (Reynaud, 2003, p. 103)

In the past decades a growing body of research has examined the extent to which and the conditions under which implementing IT systems induce a regulatory change (see, e.g., Orlikowski, 1991; Lyytinen, 1987; de Vaujany et al., 2018). Broadly speaking, we can divide these studies into two streams based on the nature of regulation that the introduced IT system brings about. We call these streams highly structured and weakly structured systems (HSS and WSS) and related regulatory processes, respectively. The content and nature of the regulation associated with these systems have consequences in terms of how implementers need to approach system implementation as a form of regulation, because in the end both types of systems have regulatory effects. Table 1 summarizes key elements of both streams in terms of the nature of system implementation as regulation; examples of systems and their functions; and key empirical references. Given the centrality of rule-making and following during IT based regulation, we next review how organizational rules are formulated, negotiated, and materialized during both types of IT system implementation and what the consequences these differences have for the ensuing regulatory process that follows from system implementation.

Implementation of Highly Structured Systems

The implementation of *highly structured IT systems* (HSS) is concerned with translating centrally (and often exogenously) agreed-on and scripted into the system rules and compelling local practices to comply with them. A script is defined as the program of actions or behaviors that an IT artifact seeks to elicit. It is expressed in terms of a series of instructions of a programming language (Latour, 1992, pp. 249–250). Typically, the script conveys organizational rules of how common organizational activities – such as ordering, hiring, or related workflows – are expected to be carried out by the organization’s members and how and to what extent their enactment will be recorded for organizational control. Thus, the execution of the scripts forms part of local practice of *elicitation*, where the rules as antecedents of scripts are expected to be followed by the IT system users making the IT use the part of the regulatory process. Highly structured IT systems are epitomized in enterprise resource planning (ERP) systems (Berente et al., 2016, see, e.g., 2019; Lyytinen & Newman, 2015; Markus & Tanis, 2000), process management systems (Dumas et al., 2018), or electronic trading systems (Mattli, 2021). All such system scripts execute, integrate, and help manage a critical nexus of the organization’s activities. A critical feature of such systems is that without the scripts, the activities and their connections would not exist.

Given the character of the rules, implementation of HSS becomes a staged process, where local rule following need to be initially unfrozen (i.e., old rules are problematized and delegitimized and new rules are offered as a possibility and a necessity). The stage is followed by a push toward complying with newly scripted rules when the system is introduced and then ensuring that the subsequent system level elicitation is successful. If not, either the script is changed or the elicitation is regulated using a stronger force or new incentives. The activity is repeated until local behaviors become frozen and comply adequately with the systems scripts and associated rules (Berente et al., 2016, 2019). During the iteration, discrepancies may emerge between local rule following and the script’s elicitation, in that users often question the legitimacy and appropriateness of the scripts and underlying rules. Implementation focuses largely on clarifying the meaning of rules locally and identifying and overcoming users’ resistance that has led to discrepancies. The process is framed around questions of compliance – that is, whether the users understand and comply with the script (Berente et al., 2016, 2019; Boudreau & Robey, 2005; Lyytinen & Newman, 2015). Recently, de Vaujany et al. (2018) introduced the ‘trifecta’ model of IT-based regulation, which cogently captures the nature of HSS based regulation “with and through IT systems” (Figure 1).



According to de Vaujany et al. (2018), HSS use as regulatory process ‘ties’ together three elements that all *jointly* are constitutive of a regulatory system: 1) organizational rules, 2) the rule-carrying artifacts (IT systems), and 3) the (sociomaterial) practices that comply (or do not comply) with the rules scripted by the IT system. *Practices* involve a gamut of routinized behavior, consisting of several elements interconnected to one another – for example, forms of bodily activities, forms of mental activities, ‘things’ and their use, and background knowledge in the form of know-how, as well as emotions and other forms of motivational knowledge (Bourdieu, 1990; de Certeau et al., 1998; Giddens, 1984; Reckwitz, 2002). *IT artifacts* enter into the regulatory process in the form of system functions that elicit user behaviors. They exemplify *organizational rules* scripted into the system.

Implementation of Weakly Structured Systems

When implementing *weakly structured IT systems* the direction between rules and practices is different: users must discover, invent, share, negotiate and legitimize scripts for system use and then express them as shareable rules. Initially, WSSs are designed to provide generic syntactic/semantic functions to search, retrieve and then store, manipulate, and display digital (semiotic) objects (DOs) and their combinations. Such DO’s typically include fragments of text, audio, video, and other forms (Malhotra et al., 2021). The digital objects serve primarily as symbolic devices supporting the conduct of a variety of daily organizational knowledge related tasks (Bailey et al., 2012). They allow organizations’ members to communicate and share knowledge (e.g., via e-mail or enterprise knowledge management systems), to convey personal opinions or facts (e.g., via social media), to build and present identity (via social media, such as Instagram), or to wield power to manipulate real-world states or a signal of such activity (e.g., simulating a car crash or operating a numerically controlled machine) (Bailey et al., 2012). These tools are viewed as ‘ready at hand’ when users need them. In this context, identifying internal and external stakeholders, or an inside from an outside of the system itself during regulation, is not that relevant – rather how the functions are interpreted locally and how their uses are explained and shared by creating and negotiating related rules for collectives.

At some point of WSS implementation, the system becomes- due to shared use- transparent while it gets filled with the needs, expectations, words, and so on expressed in the symbolic moves of the user. The equivocality of the meanings of possible appropriations of DOs is thereby reduced, while rules about the system uses are established, negotiated which legitimates certain elicitation and rejects others.

Implementing WSS requires a constant reformulation of local rules of meaningful system use. The rules scripted into systems – which users do not perceive as such eliciting scripts – have less to do with what organizational activities mean or how they will be structured. Rather, they state how families of DOs are to be technically, semantically, and/or visually organized and structured; how they will behave; or how they can be identified, presented, searched, or stored. Relying on these DOs does not define the meaning of the tasks in which the objects participate. Consider e-learning platform featuring dozens of DOs to support the teaching and learning processes. The use of DOs helps the lecturers and students define and modify the content of the study materials, the scope and organization of the learning process, including a wide range of organizational tasks such as how to evaluate the learners or the lecturer, or how to apply a chosen didactic instantiated through particular teacher-learner interaction mechanisms.

Organizational rules embedded in weakly structured systems are simple and few. Typically, they convey who has a right to use the system, and in which way: such as e.g., who can send an e-mail to whom and when. Because of the looser connection between the generic system functions offered by weakly structured systems and how they relate to practices, the uses of such systems need to be rendered meaningful at the local level during implementation. This happens mostly through local user to the user interactions at the community level whereby learning and regulation associated with system is carried out. Because of the absence of scripts determining to which organizational practices the system must *elicit* specific user behavior, system functions now *afford* users to do locally things with digital objects to achieve their task-related goals (Jung & Lyytinen, 2014; Majchrzak & Markus, 2012; Markus & Silver, 2008). In other words, meaningful uses are mostly discovered *in situ*, as an evolving family of affordances, while the system is assimilated for use and its use gradually penetrates local practices. The make the uses meaningful and legitimate they need to be expressed in simple rules that makes such uses shareable and henceforth subject to regulation.

Here, *our first research question raises the ways in which interventions related to system use translate often individually discovered affordances via negotiations among users and other stakeholders to shared and regulated affordances and how such negotiations can result in collective meaning making around system use, with a consequent demand for organizational regulation.* Contrary to HSS related regulation, where the main body of rules is *ex ante* scripted into the system *prior to the implementation commences*, implementation of WSS engenders a process of discovering and articulating affordances and *formulating associated rules*, which then build a regulatory dictum of how to use the focal system, what the use means, by whom, and under what conditions.

So far, accounts of the implementation of WSS have focused either on individual motivations to use these systems or psychological approaches that explain outcomes of such process as a learning (Denyer et al., 2011; Malhotra et al., 2021). Consequently, most implementation studies of WSS examine the gradual growth in individuals' use and view it as a manifestation of their discovery of affordances (Leonardi, 2011). The expansive use manifests users' shared learning and coping behaviors and explains *at the individual level* the continued expansion of system use across the community (Beaudry & Pinsonneault, 2005). Analyses of how *system level* use patterns emerge (Burton-Jones & Gallivan, 2007) and how communities interact and regulate system uses have been scarce. Even analyses of the emergence group level affordances¹, have focused on the organization-level effects of enacting affordances *collectively* (Leonardi, 2013, p. 752). At the same time the studies have left aside the question of how such affordances are created and made legitimate in the first place (Leonardi, 2013).

Overall, past implementation studies of WSS ignore the role of emergent, collective, open (i.e., use is not really either “in” or “out”), self-regulated behaviors while implementing such systems. Yet, as socially shared artifacts, WSS use needs to rely on normative foundations of social action (Giddens, 1984; Reynaud, 1988). This void can be formulated into a conjecture that any meaningful collective use of a WSS is not feasible *without* building a regulatory “belt,” or *layer* which renders the system use meaningful and legitimate to the focal community and directs its use toward shared means (Weick, 1979). Understanding how such regulatory regime emerges requires that we examine how various regulatory functions in terms of rules and their relationships to artefact functions and actors emerge *at the system level* from *local IT use* (Burton-Jones & Gallivan, 2007) and how they are realized and evolve as system implementation progresses.²

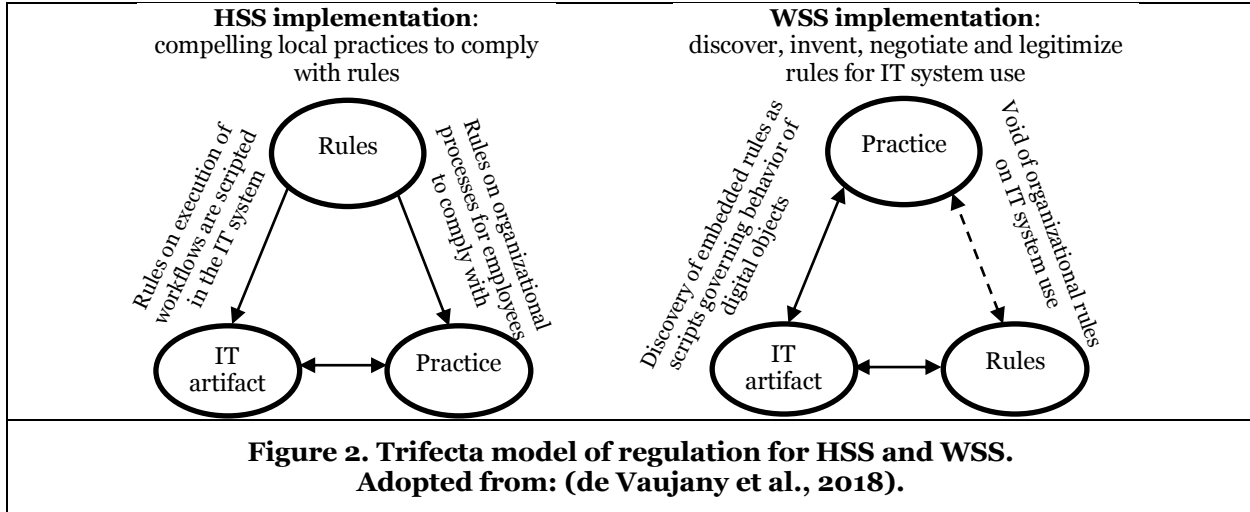
Evolution of rules when implementing weakly structured systems

Per the “trifecta” model of IT enabled organizational regulation (de Vaujany et al., 2018) (Figure 1), rules are scripted (materialized) in IT artifacts; thereafter they enter into the regulatory process in the form of system functions which will elicit pre-defined user behaviors to create compliance. In the case of WSS,

¹ Leonardi (2013, p. 752) distinguishes between “individualized” affordances at the individual level and “collective” and “shared” affordances at the group level.

² Given the ambiguity of WSS use and its regulation the regulatory process is principally open and no specific criteria can be established whether users are always compliant with the system rules as with HSS systems.

however, little, if any, centrally predefined rules for system use exist in the initial state. Instead, the system scripted rules articulate composition and behaviors for digital objects (DOs) conveyed by the IT artifact (Malhotra et al., 2021). Meaningful use of these “scripts” needs to be first interpreted locally as discovered affordances and then made visible as shared as rules how to apply the DOs. Accordingly, the “entry point” to de Vaujany et al.’s “trifecta” (2018) regulatory process changes from rules to practices (Figure 2). As the organizational rules of use and what they mean are not initially scripted in WSS, the model for regulation with and by WSS needs to add an account of how the initial void of rules is over time filled through formulation, legitimization, and scripting that creates a new regulatory system or “belt” around system use.



Several key questions emerge in such setting of how implementing a WSS is carried out as regulation: How do regulatory shifts – that is, changes in how the scripted functions of DOs are now locally enacted, interpreted, and legitimized as rules – be associated with changes in the scope and extent of system use and how it grows from local pockets of innovation to a community wide regulation? To what extent do such shifts enable or curb further implementation? And, how do such shifts create over time a “viable” trifecta of organizational regulation established by the organizational rules, IT artifacts and user practices? Only when such regulatory system is in place wider system use becomes meaningful, useful, and accepted as a given in people’s everyday activities.

Generally, for this to happen, locally discovered affordances need to become the subject of collective discussion, where rules defining and surrounding varied appropriations of technology can be formulated, negotiated, and shared. Such experiences and periods during which the IT system, related rules, and actors become visible through discussions of what can and should be done with the system by actors are called *regulatory episodes* (REs) (de Vaujany et al., 2018). REs can be seen as what Leonardi (2007, p. 829) referred to as “social pressures that lead to a discrepant event that catalyzes the next cycle until users feel comfortable that there is congruence between their interactions in the material (with the technology) and social (with their coworkers) realms”. To gain an understanding of how regulatory metamorphosis takes place from the individual affordances to the organizational level accepted use forms a salient requirement of theorizing WSS implementation as organizational regulation (Burton-Jones & Gallivan, 2007). The theorizing requires to explicate in detail what happens during regulatory episodes and with what outcomes. This calls for a detailed analysis of how WSS scripted rules are locally discovered and interpreted and how these discoveries interact with other elements of the trifecta and the environment to enable, promote, or curb the system’s use as a regulated activity.

To scrutinize the implementation of a WSS as string of regulatory episodes which gradually (trans)form the regulatory system of organization, we need to identify the types of rules that generally regulate WSS use and establish its “regulatory belt”. To this end, implementing WSS can next be characterized as the ongoing creation and removal, negotiation, and enforcement of three co-present, overlapping, and distinct rule sets that surround WSS use (see Table 2).

Rule set and its source	Purpose of the regulatory process	Implementation focus	Example from literature	References
Embedded (exogenous and endogenous)	System as a set of flexible and underspecified functions (rules) applied on digital objects materialized in the system	Discover and learn about system functions and what sort of affordances they manifest, and formulate related descriptions	Predict and define the use of on-screen agenda display in electronic meeting system	(Chin et al., 1997)
Enacted (endogenous)	Sense-making by exploring and defining goals, roles, and regulatory potential of rules that define enactment of affordances	Express rule-following and its violations in relation to affordances	Sharing of private pictures on internal enterprise networks	(Neeley & Leonardi, 2018)
Formalized (exogenous and endogenous)	Legitimizing, limiting, diffusing, and exploiting system functions through formal rulemaking	Rules dictating adoption mandates, reporting duties, and regulatory demands governing system use	Admissibility of types of data that can be entered, access rights	(Da Cunha, 2013)

Table 2. Three Rule Sets Regulating Weakly Structured Systems

We can distinguish also the regulatory sources for the rule either being within the practice (endogenous) or outside the practice (exogenous) involved in the RE. *Embedded* rules have been expressed, materialized, and scripted into the system. The rules express the composition and behavior of DOs and the established organizational controls for their use. *Enacted* rules articulate what the locally appropriated DOs behaviors mean for practices. Such rules are invented and circulated by users as system use expands. They describe and prescribe how the DOs and related system functions are to be meaningfully used. I.e., what a specific function means and when and how a specific feature is to be used as part of the local task. *Formalized* rules serve to govern the discovered meaningful system uses and connect them to the organization's broader regulatory goals. These rules legitimize some system uses while excluding others. They aim to diffuse "appropriate" affordances and regulate their use, making the system uses legitimate throughout the community. This is achieved, for instance, by conveying preferred system use goals or dictating obligatory use mandates.

The three types of rules – embedded, enacted, and formalized – are further categorized into syntactic and social. *Syntactic* rules state the content of the system functions and related behaviors, while *social* rules address the local use of these system functions and related behaviors. Each rule set is dynamic in the sense that implementation is ultimately about adding, removing, modifying, and re-organizing rules within these set and establishing their mutual relationships that allow to regulate the system use within a community.

In the following we describe in detail the evolution of rule system when implementing WSS. We use an illustrative case of a hypothetical e-learning platform to demonstrate the analytical power of the original trifecta regulatory model (de Vaujany et al., 2018) extended with lexicon specifically tailored for the analysis of WSS implementations. The case is illustrative of a weakly structured system as per characteristics defined in Table 1: it has no *ex ante* defined centralized rules for organizational workflows, but instead features a large number of digital objects which can be appropriated by multiple groups of users in different ways, and for organizational use of which shared rules have to be defined and legitimized through a joint regulation process.

The evolution of the regulatory system as joint regulation

Traditionally, system implementation has been studied in contexts of highly structured systems (HSS). HSSs by their nature carry organizational management mandates in the form of centrally (and primarily exogenously) agreed-on rules scripted as "programs of actions" that the IT artifact will elicit from its users. These scripts become materialized in the IT system as *embedded rules* (see Table 2). Different from HSS, a WSS comes void of embedded organizational rules – *ex ante*. In such systems embedded are only rules defining the behavior of digital objects (DOs) in terms of available functions and their semantics. This distinct character of WSS as a mechanism for organizational regulation makes the trifecta model (Figure 1) incomplete as an analytic device to understand regulation in the context of a WSS. To put it differently, when a WSS is introduced there is no organizational "regulatory belt" in place governing the use of WSS. In

other words, there are no scripts embedded in it for organizational processes where the artifact will be used. The trifecta model, however, posits for any meaningful use of an IT based system as regulation the use process needs to introduce a trifecta where all three of elements and all three bi-directional relationships between the three elements are in place. To establish such a regulatory system, the users need to establish through learning and negotiation such rules over time (Leonardi, 2007; Orlikowski, 1996). This process forms one critical dimension of the implementation. To understand WSS implementation as regulatory change we have to therefore understand *what* are the three elements in the context of a WSS, and *how* they relate to one another.

Generally, it is the Rules element of the trifecta that regulates socially acceptable use that is missing in the case of WSS implementation, as well as its relational connections to Practices and Artifacts (see the dashed elements in Figure 3). To understand how the regulatory system becomes erected i.e. how it evolves from incomplete/non-functional to complete/functional, we have to examine and understand how such rules become formed as an element of the trifecta and how they establish the regulatory relationships with practice (Sense-Making relationship) and IT artifact (Materialization relationship).

We next explain the evolution of the regulatory system as *joint regulation* which involved a movement from non-functional to functional based on the conjectures of the trifecta model. This calls to expand the lexicon to different types of rules that characterize the maturity of a WSS. Such lexicon formed no part of the original trifecta model (de Vaujany et al., 2018) but is needed to understand the dynamics of regulation in WSS types of systems.

We will build such lexicon based on the conjecture that the implementation of WSS starts from the void of organizational rules governing system uses (Figure 2, right). Consequently, the regulation system must be developed by moving from practices to rules, which establishes the “missing” connections between the Rules, Practice and IT elements (see the dashed elements in Figure 3). Using associated lexicon and related conjectures, we next present a process which illustrate different stages how the regulatory system surrounding WSS implementation gets gradually formed.

Table 3 and Figures 3-6 detail the evolution of rule system using the lexicon and logic of rule sets presented in Table 2. Each of the figures depicts one stage of the regulatory (trans)formation which moves WSS use from individual-level local practices (affordances) to organizational-level system use (shared affordances with related social rules). We also explicate the foci and meaning of different types of rules that emerge at each stage.

Stage 1 of the regulatory system formation: Embedded in digital objects rules (scripts) are discovered by users in their attempts to elicit desired functionality from the system. Initiation of the Practice-IT relationship

When implementation of WSS commences, the regulatory system is void of organizational rules that support related organizational processes- there are no social rules on organizational controls for the use of the system embedded into IT. Users however discover embedded scripts on digital objects as *embedded rules* which they can use to improve their tasks in practices (Figure 3).

Consider the example of implementation of e-learning platform such as Moodle or Canvas in a university. Once the IT system becomes available for use, university faculty starts discovering the e-learning platform as various DOs as e.g., “document”, “essay”, or “quiz”. Different DOs have different rules embedded within and they regulate their use socially. For example, a document can be uploaded to the system by a faculty member with certain document formats (e.g. PDF or DOC) while prohibiting others (e.g., RTF or ODF). Once uploaded, the documents can be downloaded by students. The DO “quiz” allows defining different types of quizzes and questions, setting up conditional restrictions and permissions, such as time, IP address, student name(s), etc. Rarely, if at all, university administration would define *ex ante* which specific features of DOs lecturers or students must or must not use in constructing the learning environment. The rules scripted in the system in association with DOs are discovered and created by the faculty and students mostly as individualized affordances.

	Rules	Syntactic: rules state the nature of the system functions and behaviors		Social: rules address the use of the system functions and behaviors	
Stage 1 : Initiation of the Practice-IT relationship	Embedded: Scripted into the system rules	Rules on the composition of digital objects	1.SY Scripts of syntactic rules are embedded in Digital Objects	Rules on organizational controls for the use of digital objects*	1.SO Initially, none or few rules on system uses*
Stage 2 : Enacted rules are building the Practice-Rules relationship	Enacted: individual elicitation experiences and patterns of IT system uses	What digital objects mean for local practice? Use patterns discovered as individualized affordances	2.SY Features of Digital Objects are discovered as enacted individualized affordances	How can be digital objects meaningfully used in local practice? Individualized experiences and patterns are shared among users	2.SO Shared descriptions of individualized affordances are enacted by group
Stage 3 : Preparing to formalize and materialize certain rules	Regulatory Episode: locally discovered affordances become the subject of collective discussion	The conflict between use patterns afforded by digital objects and the organizational rules	3.SY Features of Digital Objects in the context of organizational rules are debated	The conflict between individual use patterns and their meaning in the context of organization	3.SO Use contexts are debated: how shared and collective affordances can support organizational conduct
Stage 4 : Rules are formalized	Formalized: legitimize some system uses as expressed and exclude others	Shared and collective affordances are formalized as system scripts affecting behavior of DOs	4.SYf Legitimized or excluded certain system uses via system scripts	Shared and collective affordances are formalized as formal or informal organizational rules on system uses	4.SOf Legitimized or excluded certain system uses via rules
Stage 4 : Rules are scripted into the system, building the Rules-IT relationship	Embedded: Scripted into the system rules	Rules on the composition of digital objects	4.SYe Scripts of syntactic rules are embedded in Digital Objects	Scripted into the system rules on organizational controls for system uses	4.SOe Scripts supporting enactment of collective and shared affordances
<p>Legend : Colored boxes represent the evolutionary states, the arrows indicate the temporal-causal logic relating states to one another.</p> <p>Comment : Stages 1 through 4 unfold in a recursive manner as the regulatory system is being formed through the implementation process.</p> <p>* : There is a void of rules on system uses only at the initial state of the implementation process. With each cycle of completion of all 4 stages, embedded syntactic rules on composition of DOs are gradually complemented by newly embedded social rules on system uses.</p>					

Table 3. The cyclic model of the evolution of rule system

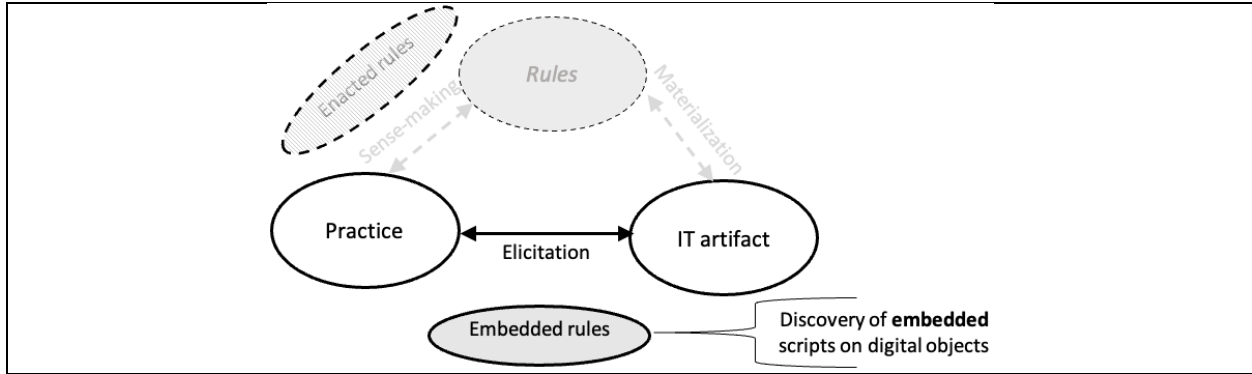


Figure 3. Stage 1: Discovery of embedded rules on digital objects as individualized affordances

According to trifecta model of organizational regulation (de Vaujany et al., 2018), users’ interaction with IT is connotated as a bi-directional “Elicitation”: users attempt to elicit the needed functionality from the IT, whereas the IT exerts UI-specific features and functions onto the users. As WSS lacks *ex ante* scripted workflow rules to exert on users (depicted in the Materialization dimension as a grey dashed line in Figure 3), users’ interaction with the system begins with the discovery of functions and features that can be elicited – that is, with the discovery of *embedded rules as scripted in digital objects* (Figure 3). Once discovered, features and functions of the IT will be enacted as individualized affordances by the users.

Stage 2 of the regulatory system formation: Users make sense of affordances at the backdrop of organizational rules. Repeated and shared patterns of use establish enacted rules building the Practice-Rules relationship

At this stage, users can share experiences (descriptions of affordances) of IT system uses and seek patterns/rules for shared and collective affordances. IT use patterns are commonly discussed in the context of organizational rules that apply to those involved artifacts and related processes (Figure 4).

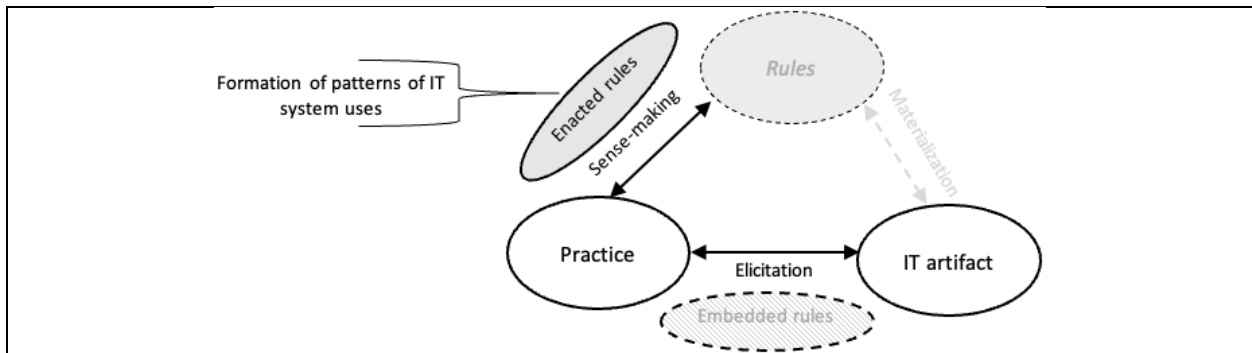


Figure 4. Stage 2: Formation of patterns of IT use (shared and collective affordances) through sharing and discussing descriptions of individualized affordances

Consider the example of implementing an e-learning platform and how the experiences from enacting individual affordances become at some point a seed for discussions. Given a variety of scripted rules for each DO, users will start sharing good and not-so-good experiences of meaningful use of DOs to support their daily study practices. For example, faculty would share experience of setting up quizzes, while students would discuss possibilities for group work as afforded by the platform. Gradually, those discussions lead to emergence of “best practices” (or to a conflict as to which are to be accepted as such) in how daily routines can be supported by specific DOs or their combinations – i.e., how to elicit specific features and functions from specific DOs while using the platform for study processes.

Figure 4 illustrates the WSS implementation at this stage as users’ sense-making activity – the users attempt to relate the functionality they elicited from IT to organizational tasks/rules. As commented above, the dashed grey “Materialization” line between Rules and IT artifact in Figure 4 depicts the absence of scripted

workflows in the system. I.e., the users elicit from the system DO-afforded functionalities, the meaning of which must be understood in the context of the users' individual and organization's daily tasks and goals. Once users start to discuss the individual elicitation experiences, patterns of IT system uses start to be formed – those patterns are referred to as *enacted rules*. In the following stages, some of the patterns will be legitimized as organizational rules, while other – rejected. Regulatory episodes (REs) are the “filtering venues”, at which users engage in collective sense-making with the aim to identify IT use patterns to be accepted or rejected.

Stage 3 of the regulatory system formation: Enacted rules are scrutinized. Preparing to formalize and materialize certain rules

During Stage 3, discussions (collective sense-making) take place around patterns of WSS use and how they relate to organizational tasks, roles, etc. This leads to formulating new rules of use that legitimize certain use patterns and rejecting others as typified affordances (Figure 5).

The early stages of the use of e-learning platform would lead to diverse individual patterns of use of DOs – some uses will be considered as awkward or inappropriate by some users or the administration. One example of questionable or strictly inappropriate use is the posting of potentially or definitely sensitive personal or other information to all users. Consider how students' grades for a quiz can or should be made visible to all students. Whether erroneously or due to being oblivious to how the DOs act on the e-learning platform, faculty may post to all students information which is meant to be strictly personal. Another example is when students disseminate through e-learning platform documents or messages of inappropriate content which may not relate to course topics. Such cases, either by an administrative mandate or by a bottom-up users' initiative, need to be discussed with the aim to define appropriate rules of using specific features or functions of the system for specific affordances.

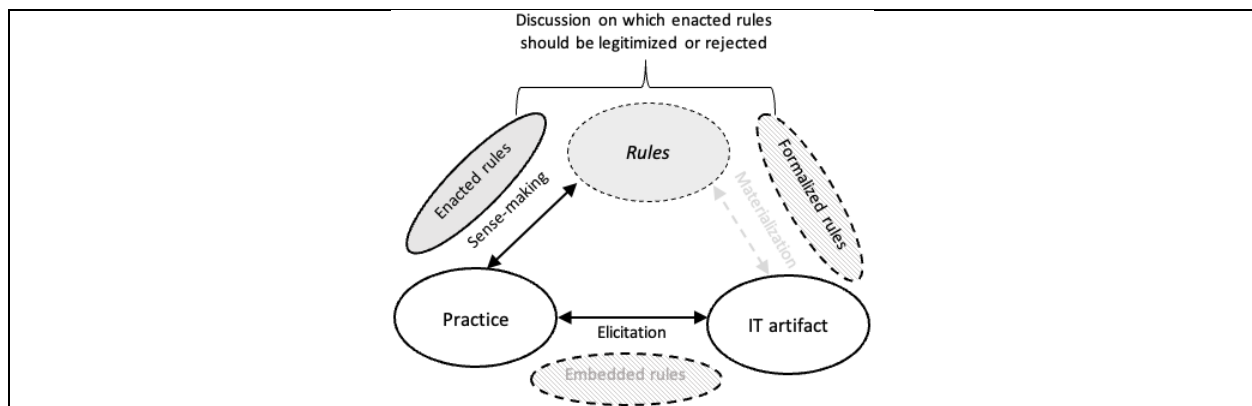


Figure 5. Stage 3: Group discussions on the patterns of IT use vs. organizational tasks, roles, etc. leading to formulation of rules legitimizing certain use patterns and rejecting other

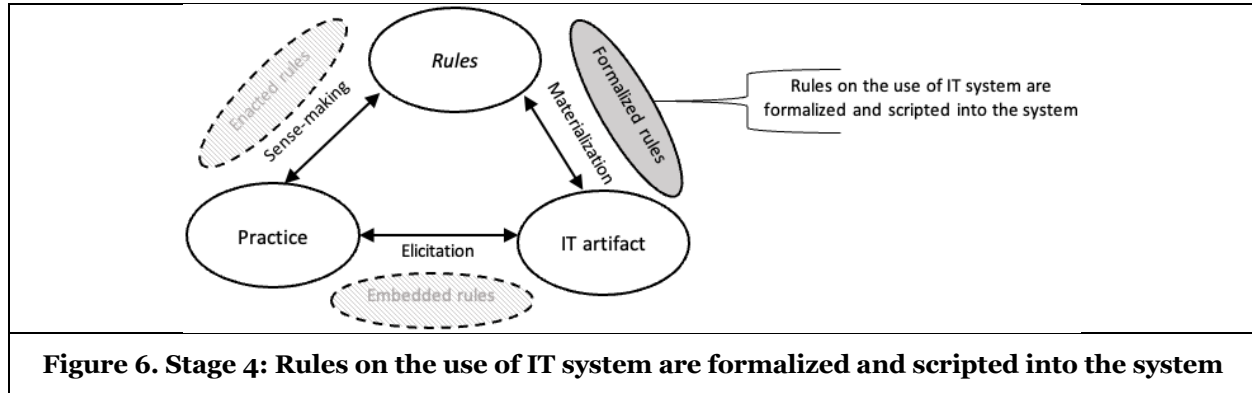
Figure 5 depicts the formation of organizational rules for IT system use. The Rules element of the trifecta model – previously void of organizational rules on IT use – starts to be filled with content. Not all previously enacted rules (or else – patterns of IT use) will be found to be appropriate and/or contributing to the fulfillment of individual and organizational tasks and goals. Through discussions and collective sense-making involving both the users and the administration, the conflicts between individual use patterns and organizational rules are identified, leading to rejection of certain previously formed IT use patterns and legitimation of other (Figure 5).

Stage 4 of the regulatory system formation: Rules are formalized. Syntactic rules are materialized in (scripted into) the system. The Rules-IT artifact relationship starts to form

During the final stage, previously legitimized rules on the use of IT system are formalized as organizational rules, and, whenever feasible, scripted into the system (Figure 6).

Let's consider the previous examples of e-learning platform use. Rules regarding what constitutes appropriate or inappropriate content disseminated via the e-learning platform will be formalized through

administrative mandates, user guides, or policies. Whenever feasible, newly defined and legitimized *social and syntactic rules* can be *embedded* into the WSS. For instance, adjustments in the system settings for acceptable document formats, types of quizzes serve as examples of *syntactic rules*. Examination-specific conditions related to them (such as IP address filtering, “exam mode”, synchronization of start- and end-times with the examination schedule, etc.) can be seen as examples of *social rules*.



Embedding social rules as scripts to support the enactment of certain affordances or workflows and including *syntactic rules* that define the behavior of digital objects (DOs) within the system marks the completion of one iteration in the development cycle of the regulatory system. The state of the trifecta, as captured in the last row of Table 3, becomes the starting point for the next iteration. The key difference is that the initial void of rules regarding IT system use gradually fills with newly legitimized rules that are scripted into the system to support organizational rules and policies.

In summary, as demonstrated in Table 3 and Figures 3-6 with accompanying examples, the implementation of a WSS gradually the trifecta of an organizational regulatory system. Unlike the implementation of HSSs, where centrally issued organizational rules guide users' daily work, WSS implementation, such as e-learning platforms or video-collaboration tools, begins with few or no *ex ante* rules for guidance. The initial absence of rules on “what” to use and “how” to use digital objects is gradually filled with shared rules. Users start by discovering features and functionality of IT as individual affordances, then discuss their IT uses experiences with others to refine “best practice”, and finally define rules governing “legitimate” and “unwanted” ways to use the system. Some rules are established through external organizational mandates, while others become materialized in the IT system as scripts and workflows. As the “regulatory belt” for the WSS is gradually built, the system acquires characteristics similar to highly structured system (see Table 1). From that point onward, existing knowledge and models for IT system implementation can be applied to its analysis.

Limitations and future research

Our work introduces theoretical constructs – a model and the associated vocabulary (Weick, 1995) - to advance theorizing of weakly structured systems. Any theorizing must be considered within a specific context (Johns, 2006) to establish boundary conditions for the validity of the theory (Sutton & Staw, 1995). In the following, we specify the key variables for our theorizing and evaluate their effects on the proposed model.

The boundary conditions for our theory can be established by the definitions adopted for three critical aspects: 1) what is understood as an IT implementation process, 2) what distinguishes WSS from HSS, and 3) what defines the organization in which the implementation process takes place.

We define the IT implementation process as the assimilating IT solutions into an organization’s processes and ways of working. In this research, we adopt Weickian (1979) view on organization as a collective structure characterized by interlocked routines, habituated action patterns, imposed norms on its members, and the necessity for a convergence on rules to maintain it. Given this background, a distinction between HSS and WSS can be discussed in terms of the nature and type of change and implementation each type of system requires, considering the different ontologies of rules.

In reality, the majority of current IT systems are hybrids of both HSS and WSS characteristics. Therefore, several relevant implications of our theorizing differences can be noted. HSSs are traditionally developed and implemented to support the established, well-structured and interlocked organizational routines, whereas WSS can be said to be developed without a regard for interlocked and highly-structured aspects of routines, because of the lack of embedded workflows (social rules) in WSS. In HSS systems, the embedding of social and syntactic rules takes place (1) *ex ante* by system developers, and then (2) they are refined and enforced during the implementation process, given the character of those rules (3) primarily on the top-down manner – dictated by the mandate of management. We assume WSS enter organizations with no or few embedded social rules, and no or few pre-defined embedded workflows and therefore do not require implementation mandates from management.

As we treat WSS implementation as a movement from (local) practices to rules, several factors such as user motivation and users' attitudes towards discovering, sharing, and negotiating use experiences are likely to affect (curb, aid) the implementation process and outcomes. In particular, attitudes and varying motivations may affect the scope, intensity, or frequency of the discovery, but cannot substitute for the nature of the discovery: per our definition of affordance and organization, any interaction of the user with a WSS system with novelty is likely to result in the discovery of system features with a local meaning and action potential and contributes to generating elicitation and sense-making relationships within the trifecta model.

Of note is that the proposed classification of rules is not necessarily exhaustive, and we may have missed categories of rules important in the study of IT implementation. In this regard, the proposed model of rule evolution outlines minimum necessary rule types for a regulatory system to form and the stages of this evolution. We however emphasize that the process is never linear nor that all systems rules evolve at the same pace and chronology. With WSS systems this is never the case, while with HSS by definition the rule implementation and following needs to advance largely at the same pace. This makes the implementation of WSS emergent and organic. Finally, the proposed model does not account for potential effects of different types of rules during implementation process, in the sense that the more of a rule type A or B can inhibit or speed up the implementation process. Future research should test the validity of the presented model under different contextual conditions, these discussed here and other potentially relevant which we have overlooked.

Conclusions

In the past, a well-trodden stream of research has investigated how highly structured systems (HSS) such as enterprise resource planning (ERP) or electronic health record (EHR) systems are implemented and how their implementation expresses a movement from central rules to practices (Berente et al., 2016, 2019; Boudreau & Robey, 2005; Dumas et al., 2018; Volkoff et al., 2007; Volkoff & Strong, 2013, 2017). In contrast, little theoretical and empirical attention has been paid to how implementing a weakly structured system (WSS) forms a movement from practices to newly discovered rules which are then formalized and legitimized.

This paper recognizes the distinctiveness of WSS at the backdrop of the established research on IT enabled organizational regulation. By theorizing the formation of an organizational regulatory system during the implementation of WSS, we respond to the call to further the knowledge of how individual-level system uses (Leonardi, 2013) typically undergo a transformation into what becomes a group-level organizational phenomena (Blanka et al., 2022; Burton-Jones & Gallivan, 2007). We posit that WSS implementation forms a new family of IT systems which are being increasingly adopted by organizations including AI-based systems, e-learning platforms, knowledge management systems, etc. Often such systems are sought as vehicles for the digital transformation (DT) of enterprise. In this light, our work establishes a foundation for further theorizing a number of issues related to digitization efforts. E.g., the relationships between the use of IT and the response of organizations to digitization (Blanka et al., 2022, pp. 1–2), or the relationship between user-driven digital innovation and the strategic management levels of organizations (Opland et al., 2022, p. 262).

While recognizing the analytical power of “trifecta of organizational regulation” (de Vaujany et al., 2018) to study IT implementations, this research is motivated by realization that trifecta model cannot be readily applied in studies of WSS implementation. Using the lexicon established in previous research, analytic

inferences and illustrative examples, we demonstrate how organizational regulatory system surrounding the WSS use is gradually formed through bottom-up and top-down regulatory interventions by system users and organizational administration. Our research thus expands the lexicon and extends the analytic scope of the trifecta model (de Vaujany et al., 2018) to enable/accommodate analysis of implementations of weakly structured systems as *joint regulation* process (de Vaujany et al., 2018; Reynaud, 1988). Specifically, our work lays bare some critical concepts to advance to theorizing of such systems and their use by articulating mechanisms which enable WSS implementation as a movement from user experimentation to formulating and enforcing shared organizational rules for system use.

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