RECONCEPTUALIZING ENTERPRISE SYSTEMS

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Enterprise Systems (ES) are traditionally seen as a specific category of Information Systems (IS). They offer a set of functional modules, generally based on industry best practices (Markus and Tanis 2000). In contrast to traditional IS, ES target large-scale integration of data and business processes across a company's functional areas (Devadoss and Pan 2007). Consequently, the complexity of ES is higher than in traditional IS as they tend to have organization-wide impact rather than localized effect (Strong and Volkoff 2010). Due to this complexity, organization-wide resources are involved and significant change is generally required during the (post-) implementation phase (Devadoss and Pan 2007).

Extending current definitions of ES, which are often used synonymously with those for application systems such as ERP, we suggest that adequately accounting for these characteristics requires a reconceptualization of both ES and their transformation, that is, the dynamics implicated in changing these systems. Our proposed conceptualization puts a stronger emphasis on the social perspective by equally accounting for the organizational, the technological, and the individuals involved (O-I-T). A key argument for this extension is suggested by understanding ES as socio-technical. Since originally proposed in the 1960s (e.g., Emery and Trist 1960), socio-technical approaches have informed both organizational (e.g., Appelbaum 1997) as well as technological (Bansler 1991; Bostrom and Heinen 1977a, 1977b; Mumford 2006) research relevant for a changed understanding of ES. In building on a socio-technical view (Bostrom et al. 2009; Orlikowski 2010), we understand ES as an ensemble in the sense of an inseparable package bound together by the dynamic interactions between people and technology (Orlikowski and Iacono 2001) where interactions emerge when employees try to make sense of and apply technology to complete a task (Orlikowski 2000).

Figure 1 depicts the key structural constituents of our ES reconceptualization. From an organizational perspective, we consider context (e.g., strategy, culture, …), resources, and the organizational structure as the three major elements. Viewing organizational structure as "formal system of task and authority relationships that controls how people are to cooperate and use resources to achieve the organization's goals" (Jones 2013, p.30), we decompose it into a functional (e.g., departments, roles,…) and procedural view. From a procedural view, we emphasize the importance of processes, which represent "a set of steps to achieve an objective" (Overby 2012, p.108). Finally, process steps can be described as tasks on the most granular level.

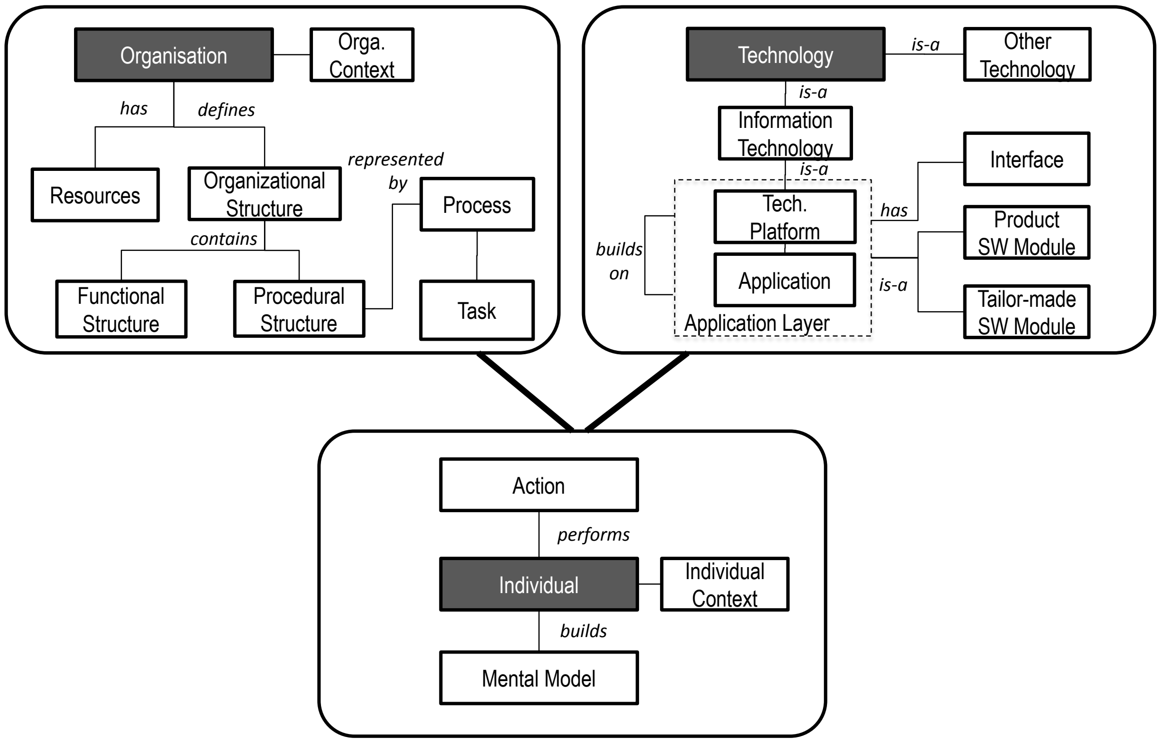

Figure 1: Constituents of an Enterprise System

From a technological perspective, we distinguish two kinds of information technology components: (1) a technology platform, and (2) applications building on the platform. We allow for establishing platform-application layers (PAL) in the sense that a new PAL can build on top of a PAL. Each PAL exposes functionality through its interface (Ferstl and Sinz 2008). For example ERP software builds on an operating system, database system, and application server layer and exposes a comprehensive set of applications on top of it. Finally, a mobile layer may build on top of the ERP software and expose specific services as packaged user applications to the users. Applications are distinguished into either standard application software modules provided as product software or tailored application software modules. An example of a tailored application software module is a spreadsheet with data from the ERP layer.

Individuals can be characterized by their context (e.g., gender, age, …), their mental model (i.e., their understanding of what is going on as an abstract network of relationships among organizational, social, technological, and individual aspects) as well as their behaviors in the form of actions. Individuals executing actions in an organizational environment usually refer to defined tasks and leverage different user applications.

According to Action-Regulation Theory, the individual execution of actions in the organizational environment can be described as "circular unit of action" (CoA) (Groskurth and Volpert 1975; Hacker 2005) The CoA starts with the goal setting, where the individual seeks orientation and engages in sensemaking to set goals (in the sense of Weick 1995). In our framework this means that individual level goals are derived from tasks and are formulated in relation to the user applications thought to be appropriate in this situation. Note that the process of relating goals, tasks, and user applications to one another to make them meaningful (sensemaking), is shaped by and in turn shapes the mental model of the respective individual. The individual takes the goal as guideline to define a plan for achieving the goal. The plan is the anticipation of a sequence of sub-goals or stages that are then executed in actions. On each stage the relationship between individual and environment is transformed and the individual controls for goal achievement after each transformation (Bamberg et al. 2011). CoAs are embedded in goal hierarchies, that is, they are typically derived from higher order goals.

This reconceptualization of the structural constituents of an ES following a socio-technical stance and the notion of dynamic interactions and sensemaking suggests that the classical ES lifecycle models (e.g., Markus and Tanis 2000) cannot fully describe and explain the whole scope and complexity of (post-) implementation processes. Therefore, we suggest a complementary dynamic view that we define with the concept of ES Transformation. Our theoretical suggestions are motivated and underlined by our ongoing research.[1]

In our research case, management decided to increase efficiency by introducing new technology. Several sub-projects planned, implemented, and rolled out consecutive releases of the technology. The delivery organization (DO), as project organization, was responsible for the sub-projects that converted IT expenditures in terms of project budget to IT assets (Soh and Markus 1995). This DO was primarily formed by members of the IT department. Note however that in the case of standard software the development of the technology is done by the service provider (SP) (Swanson 1994). After roll out, the overall goal was not yet achieved, since the benefits of the technology have not yet been realized. Therefore the affected sub-units (e.g.,, branches, back-, or middle-office) and the respective individuals of the host organization (HO) must use the technology and realign work practices and system functionality to generate the intended benefits (Swanson 1994). Before the conversion and use cycle started in our case, additional activities such as a feasibility study were performed that we include in the ES Transformation concept as (pre-) adoption phase (Damanpour and Schneider 2006).

Similar to the actions of individuals, Business and IT Transformations that create different versions of the socio-technical constituents of the ES (O-I-T) in different points in time can be described as a hierarchy of CoAs (Figure 2).

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[1] We study a large-scale and multi-year IT program at Mercury, a German Bank. It deals with the introduction of a core banking platform based on standard software and the enhancement of several applications building upon the platform. During a half year exploration of the case site, we developed an ES Transformation framework that helped us to theoretically frame the observations we made there. Detailed narrative of the case can be received from the authors on request.

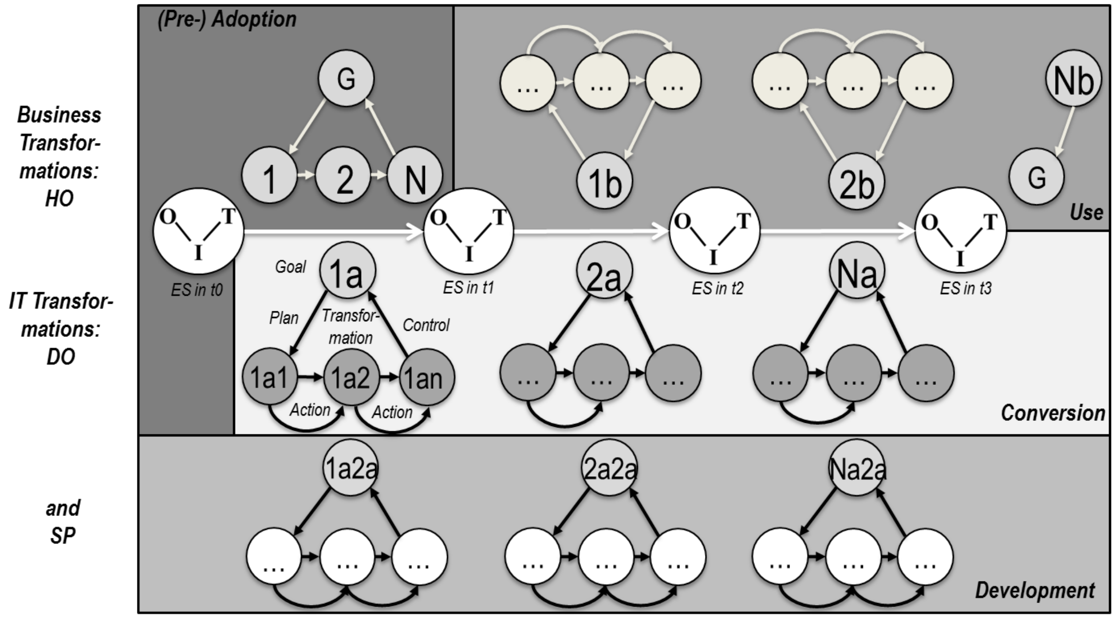

Figure 2: ES Transformation Framework

From the iterative implementation of parts of the technology follows, that the overall goal of introducing a new technology G is translated into multiple sub-goals (i.e., a plan) which form the basis for the subsequent goal-formation in the different entities involved (e.g., HO, DO), as described above. For example, in the conversion phase DO gets a business mandate to implement the technology and creates goal 1a (implement first release until t1) that is derived as sub-goal from the organizational goal 1.

The derivation of lower level goals (of the sub-units) from the initial plan of the overall transformation has important implications for the possibilities of actors to act in a particular situation. For example, changes to technology are planned to occur in the conversion phase only and are thus decoupled from the immediate need of users as change requests have to be formulated, decisions about the implementation will be made, and, after considerable time, changes may eventually be implemented. This may constrain the perception of possible reactions to problems encountered with the new technology. Still, smaller changes typically can be implemented immediately, softening the separation of phases and opening the field for social processes like discussions of what constitutes an issue that should be resolved immediately.

From the conceptualization of ES transformation as hierarchy of CoAs follows, that in addition each individual needs to set his own goals and plans and thus experiences several stages of transformation while performing his actions. This is true for both the use and conversion phase, but may be particularly severe with regard to system usage as the users are confronted with a fundamentally new situation and have to considerably reconstruct their mental models. The technology may or may not work as anticipated by users (Pickering 1993). This will in any case lead to adaptations of other O-I-T constituents and their relationships (e.g., change requests for the technology) (Beaudry and Pinsonneault 2005). Furthermore, individual interpretation and actual usage (guided by understanding/mental model) may influence the usage of the technology by others (e.g., understanding of field semantics deviates between users and influences data entry and interpretation). Moreover, the process of deriving sub-goals from higher level goals also depends on the sensemaking process of the individuals involved and may thus result in more or less deviation from the original goal depending on the individuals understanding.

References

Appelbaum, S. 1997. “Socio-technical systems theory: an intervention strategy for organizational development,” Management Decision (35:6), pp. 452–463.

Bamberg, E., Mohr, G., and Busch, C. 2011. Arbeitspsychologie, (1st ed., Vol. 1) Hogrefe-Verlag, p. 301.

Bansler, J. 1991. “Systems development research in Scandinavia: three theoretical schools,” Scand. J. Inf. Syst. (1:9)Aalborg, Denmark, Denmark: University of Aalborg, pp. 3–20.

Beaudry, A., and Pinsonneault, A. 2005. “Understanding User Responses to Information Technology: A Coping Model of User Adaptation,” MIS quarterly (29:3), pp. 493–524.

Bostrom, R., and Heinen, J. 1977a. “MIS problems and failures: a socio-technical perspective, part II: the application of socio-technical theory,” MIS quarterly (1:4), pp. 11–28.

Bostrom, R., and Heinen, J. 1977b. “MIS Problems and failures: a sociotechnical perspective part I: the cause,” MIS quarterly (1:3), pp. 17–33.

Bostrom, R. P., Gupta, S., and Thomas, D. 2009. “A Meta-Theory for Understanding Information Systems Within Sociotechnical Systems,” Journal of Management Information Systems (26:1), pp. 17–48.

Damanpour, F., and Schneider, M. 2006. “Phases of the Adoption of Innovation in Organizations: Effects of Environment, Organization and Top Managers1,” British Journal of Management (17:3), pp. 215–236.

Devadoss, P., and Pan, S. 2007. “Enterprise systems use: towards a structurational analysis of enterprise systems induced organizational transformation,” Communications of the Association for Information Systems (19:17), pp. 351–385.

Emery, F. E., and Trist, E. L. 1960. “Socio-technical systems,” in Management Science Models and Techniques, C. W. Churchman and M. Verhulst (eds.), Oxford: Pergamon.

Ferstl, O. K., and Sinz, E. J. 2008. Grundlagen der Wirtschaftsinformatik, München: Oldenburg.

Groskurth, P., and Volpert, W. 1975. Lohnarbeitspsychologie: berufl. Sozialisation; Emanzipation zur Anpassung, Fischer-Taschenbuch-Verlag.

Hacker, W. 2005. Allgemeine Arbeitspsychologie: Psychische Regulation von Wissens-, Denk- und körperlicher Arbeit, Aufl. Bern: Huber, Huber, p. 890.

Jones, G. 2013. Organizational theory, design, and change, Harlow, UK: Pearson Ed.

Markus, L., and Tanis, C. 2000. “The Enterprise System Experience— From Adoption to Success,” in In Framing the Domains of IT Management: Projecting the Future Through the Past, (Vol. 173) , pp. 173–207.

Mumford, E. 2006. “The story of socio-technical design: reflections on its successes, failures and potential,” Information Systems Journal (16:4)Wiley Online Library, pp. 317–342.

Orlikowski, W. 2000. “Using technology and constituting structures: A practice lens for studying technology in organizations,” Organization science (11:4), pp. 404–428.

Orlikowski, W. 2010. “The sociomateriality of organisational life: considering technology in management research,” Cambridge Journal of Economics (34:1), pp. 125–141.

Orlikowski, W., and Iacono, C. 2001. “Research commentary: Desperately seeking the‘ it’ in it research—a call to theorizing the it artifact,” Information systems research (12:2), pp. 121–134.

Overby, E. 2012. “Migrating Processes from Physical to Virtual Environments: Process Virtualization Theory,” in Information Systems Theory, Y. K. Dwivedi, M. R. Wade, and S. L. Schneberger (eds.), Springer New York, pp. 107–124.

Pickering, A. 1993. “The Mangle of Practice : Agency and Emergence in the Sociology of Science,” American Journal of Sociology (99:3), pp. 559–589.

Soh, C., and Markus, M. L. 1995. “How IT creates business value: a process theory synthesis,” in ICIS 1995 Proceedings, Paper 4., pp. 29–41.

Strong, D., and Volkoff, O. 2010. “Understanding organization-enterprise system fit: a path to theorizing the information technology artifact,” MIS Quarterly (34:4), pp. 731–756.

Swanson, E. 1994. “Information systems innovation among organizations,” Management Science (40:9), pp. 1069-1092.

Weick, K. E. 1995. Sensemaking in Organizations, Thousand Oaks, Ca, USA: Sage Publications.