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Model-enabled Design & Engineering of Organisations and their Enterprises

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Abstract This editorial is concerned with the need for an integrated approach to the design and engineering of organisations and their enterprises. Organisational Design originates from the organisational sciences, while the notion of Enterprise Engineering results from the engineering sciences (most notably information systems engineering, business (process) engineering, business process optimisation, and enterprise architecture).

The Organisational Design & Enterprise Engineering (OD&EE) journal is built on the premise that there should not be an "either-or" relation between Organisational Design and Enterprise Engineering, but rather an integrated approach that brings out the best of the two. A driver for the creation of the journal was the observation that the "either-or" mindset was (and still is) a major obstacle to the development of organisational thinking, and that this artificial divide must be abolished.

In achieving more integration between Organisational Design and Enterprise Engineering, we suggest to take a model-enabled approach, where models should act as boundary objects between the social processes involved in organisational design processes, and the more analytical and rational side of enterprise engineering.

Keywords Organisational Design · Enterprise Engineering · Model-enabled Design

1 Introduction

Periods of great change in human society have often been driven by the advent of disruptive technologies, such as the introduction of the printing press, the steam engine, the automobile or the telephone. The introduction of each of these technologies has brought about fundamental change in society's culture and economy.

The emergence of information technology initially enabled organisations to automate their information processing activities. As such, the initial use of information technology

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aimed to amplify the cognitive abilities of humans. Soon after that, information technology also started to be used to steer machines. This enabled us to amplify our abilities in the physical sense, resulting in the automation of manual processes using robotics. An inspiring quote in this regard, is the following statement by Konrad Zuse: "*Der Mensch soll sich von fremdbestimmten Tätigkeiten befreien und sie Maschinen überlassen, um sich selbst stärker zu entfalten.*" (Humans should rid themselves of externally determined activities, and leave such activities to machines in order to better develop themselves).

The on-going miniaturisation of hardware, the integration of information technology and communication technologies, the networking of information technology on a global scale (i.e. the Internet), the advent of mobile computing, and the introduction of different networked sensors, enabled us to amplify our communication/dialoguing capabilities as well as (remote) sensing capabilities.

As a result, we are now confronted with a new socio-technical reality in which social actors (humans) interact closely with digital-technological actors (information technology), while jointly controlling and managing physical-technological actors (cars, smart-buildings, machines, heating systems, lighting systems, traffic control, factories, etc). Taylor (1982) already provided interesting insights into the possible far reaching consequences on communication and coordination in organisations, in particular in shaping the administrative structures of organisations. The resulting *social-digital-physical*[1] web of actors might be called an ActorWeb (Proper, 2001; Proper and Smit, 2001; Proper, 2008). Such hybrid webs of social-digital-physical actors, represent the latest wave of disruptive technologies, where people, information, artefacts and knowledge are converging, collaborating and innovating at an unimagined intensity.

Illustrative examples of ActorWebs include logistic chains where humans work together with machines to transport RFID tagged goods, while e.g. also monitoring the status of perishable goods, and base their shipping priority on this status. A second example of an ActorWeb are smart cities in which people, transportation means, buildings, and infrastructures all interact to optimise traffic flows, energy use, and ease of living. A third example would be a (smart) airport, which typically comprises of an interconnected system of people, luggage transport systems, cargo flows and aircraft handling. A fourth example of an ActorWeb would be a remote factory, in which people operating a factory are e.g. located in Melbourne or Luxembourg, while the actual factory (or mining operation) is located in e.g. India.

In parallel to these technological developments, and to some extent even enabled by these technologies, we have seen a clear shift towards globalisation and global competition. This requires organisations to increasingly focus on the ability to combine their own core competences with the competences of others, in order to provide/deliver distinguishing products and/or services. For example, Friedman (2005) states that businesses are not formed merely based on the core competencies they have, but rather on their ability to provide services by clever combinations of outsourcing and renting through service providers around the globe. These developments have indeed prompted several organisations to restructure themselves as collections of specialised parts, with the aim to increase the agility of the organisations as a whole. Organisations are forced to decentralise (Hagel III and Singer, 1999; Malone, 2004; Galbraith, 2000). Traditional fixed organisational structures are being replaced by more dynamic networked structures (Friedman, 2005; Hagel III and Armstrong,

[1] Even though it has become commonplace to use the word 'cyber' as a general prefix to refer to computer controlled activities, we prefer the word digital. The prefix 'cyber' originates from cybernetics, which represents the art of steermanship (Ashby, 1956), which was intended as a generic notion and was not intended to be uniquely linked to the use of computers for steering and control.

1997; Camarinha-Matos and Afsarmanesh, 2004; Tapscott et al, 2000; Umar, 2005), also blurring borderlines between existing organisations within the same value chain/web. Umar (2005) introduces the notion of *next generation enterprises* (NGE), which conduct business by utilising innovative new business models. He claims such a next generation enterprise (known by names such as virtual enterprise, networked enterprise, real-time corporations, etc.) will be the standard way of doing business, given its agility and ease of set up.

We regard the shift towards networked organisations and the advent of *social-digital-physical* ActorWebs as mutually enforcing developments. These dramatic changes present a pressing need for new design and management capabilities, which will enable people and organisations to deal best with the new ways in which work is organised and executed. A key challenge is the integrated design of the social and the technical aspects of the social-digital-physical ActorWebs. As reported by for example, Zammuto et al (2007) and Zmud (2003), one of the major problems as encountered in the organisational world, is the problem of integrating social and technological architectures of soco-technical systems. A major gap exist between these types of architectures, while the discipline of information systems is still to find adequate ways to bridge this gap. The advent of ActorWebs makes the need to bridge this gap even more pressing.

In our view, among the key reasons behind this gap is the on-going divorce between people who develop and maintain the technological architectures, those who develop and maintain the social architectures, those who make the associated investment decisions, and the social actors that (are to) play a role in the resulting ActorWebs.

From the perspective of academic disciplines, there are also crucial divides between those who research and theorise within each of these realms of architecting. Social architectures lie in the domain of social sciences, while technical architectures lie in the domain of the engineering sciences (most notably information systems engineering, business (process) engineering, business process optimisation, and enterprise architecture). In the social sciences the notion of social architectures is embodied by *organisational design* (Kimberly, 1984) thinking, while from an engineering sciences perspectives, this has resulted in the emergence of a discipline which may be called *enterprise engineering* (Vernadat, 1996; Österle and Winter, 2003; Dietz, 2006; Tribolet et al, 2008; Aier et al, 2009; Dietz et al, 2013). Alternative names in use for this discipline are e.g. *business engineering* (Österle and Winter, 2003; Aier et al, 2009) and *organisational engineering* (Tribolet et al, 2008), while we consider e.g. *enterprise architecture* (Bernus et al, 2003; Lankhorst, et al., 2012; Op 't Land et al, 2008) to be an integral part of enterprise engineering.

As we will argue in more detail below, we consider it to be necessary to combine the two notions; i.e. Organisational Design *and* Enterprise Engineering. We also take the view that a model(ling) enabled approach can be instrumental in integrating these two stances, in particular by using models as boundary objects between the different groups involved (Abraham et al, 2013).

The realisation of the need to integrate technological and social change in society at large, and in organisations in particular, brings to the fore the potential contributions that can be made by the discipline of *information systems*. Situated "at the intersection of knowledge of the properties of physical objects (machines) and knowledge of human behaviour" (Gregor and Jones, 2007, p. 313), the discipline of information systems is increasingly being described as belonging to the theoretical domain of "design". Set apart from theories for analyses, explanation or prediction, design theories are those which "give explicit prescriptions how to design and to develop an artefact, whether it is a technological product or a managerial intervention" (Gregor and Jones, 2007, p. 313).

This editorial does not aim to provide a conclusive overview of all the issues involved, it rather aims to further clarify the scope and mission of the Organisational Design & Enterprise Engineering (OD&EE) journal, while at the same time also raising and addressing more specific challenges and research questions. In the remainder of this editorial, we will first (section 2) explore the concepts of organisation and organisational design in more detail. We then (section 3) propose to integrate the design and engineering perspectives in terms of model-enabled design and engineering of organisations and their enterprises. Using this as a starting point, we continue (section 4) with a discussion of specific challenges for an integration between organisational design and enterprise engineering. Before concluding, we discuss (section 5) the position of the OD&EE journal in furthering research to meet these challenges.

2 Organisations and their design

An organisation is a configuration of resources (social, digital and physical) and activities in pursue of a purpose. It is an invisible construct used to harness and direct the energy of the people who do the work, and it exists when people interact with one another to perform essential functions that help to attain goals (Daft, 2007; Kates and Galbraith, 2007). As such, they are social-digital-physical systems, which self-realise in the actions and interactions of its constituent parts. The purpose of an organisation and the systematic way it endeavours to achieve its purpose can be regarded as its *enterprise*, where we regard enterprise as being "*a systematic purposeful activity*" (Meriam–Webster, 2003).

In modern day organisations, the technological elements tend to take shape as "*Intelligent Technology (IT)*" (Proper, 2014), including information technology, communication technology, robotics, sensor networks, drones, etc. These intelligent technologies invade all corners of organisational life, facilitating the process of coordination and control, increasing the effectiveness of current organisational designs and making it feasible to innovate these design in fundamental ways. As discussed above, as a result organisations should really be regarded as as *social-digital-physical* webs of actors; ActorWebs (Proper, 2001; Proper and Smit, 2001; Proper, 2008).

We might talk about the discipline of *organisational design* ever since the classical writings of Weber, Fayol and Taylor, when the notion of organisational structure was introduced for the first time. Organisational structure is generally defined as the artefact which defines levels of responsibility, authority and accountability, the nature and the extent of formal rules and procedures, the organisation of task-related units and sub-units, human resources policies and procedures, as well as the relationships of all the above to environmental conditions (Kimberly, 1984). The mainstream school of thought of organisational design research, dating back to the 1950s, was inspired by a positivist epistemology and was driven by a desire to find the right structure for given environmental conditions. Included in this trend are the contingency school of thought spearheaded by Thompson, Woodward, Lawrence and Lorsch, followed-up by the information processing movement fronted by Galbraith, Tushman, Nadler or Daft, to mention only a few.

In the 1980s, organisational design theory received an important contribution from literature with a more interpretive bent, which made the point that the organisation's response to the environment is crucially mediated by the interpretations made about the environment by managers and other organisational members (Bartunek, 1984; Daft and Weick, 1984; Kiesler and Sproull, 1982; Weick and Roberts, 1993). Such findings cast initial doubts about the simple linearity between the environment and the structure. A related and more recent per-

spective has invited serious consideration to the fact that organisational design is not just a static noun (i.e. "the configuration") but is also, and perhaps more importantly, a permanent process of *designing* (Boland et al, 1994; Ciborra, 1996; Garud et al, 2006, 2008; Sarasvathy et al, 2008; Yoo et al, 2006). This literature has played a crucial role in demonstrating that history plays an important role and that organisational design is an emergent and never-ending process. Moreover, it also emphasises the point that rather than being determined by the existing environments, organisational designs have the ability to shape and even create new environments.

A third category of organisational design research takes an actor-oriented approach and integrates aspects of artificial intelligence, organisation studies and system dynamics/simulation. One branch in this category is known as Computational Social Science and involves the design of computational tools to support computational experimentation aimed at emulating micro-level behaviours in organisations (Carley and Lin, 1997; Carley and Prietula, 1994; Levitt et al, 1999; Nissen and Levitt, 2004; Nissen, 2014). A second branch, closer to strategic management concerns, emphasises a turn away from the disembodied notions of contingency and structure and recognises that organisational design is fundamentally about people and relationships (Gulati et al, 2012; Fjeldstad et al, 2012). Organisational design is seen as an architecture of collaboration based on actor-oriented architectural schemes, expressed not as configurations of organisational structures but as sets of principles which actors follow when engaging in organisational relationships. Puranam (2015) proposes a "micro-structural" approach and elects the processes of dis-aggregation and re-aggregation that link individuals to the organisation as the fundamental organisational design issue.

Any theorising about organisational design will depend on the adopted assumptions about the nature of organisational knowledge. Knowledge is important in organisational design research, given its role in contemporary micro-economic thinking on the topic of the theory of the firm. The resource-based view states that organisations should be understood as unique bundles of idiosyncratic resources and capabilities that become the only source of differentiation in the competitive marketplace (Barney, 1991; Rumelt, 2011). Such resources and capabilities make up the organisation's knowledge-base. According to the constructionist perspective, knowledge has no objective reality, but is something that keeps being constructed and reconstructed by organisational actors while communicating and intervening in their internal environments. Actors are persons or groups of persons with roles, interests and values who use different signs and symbols to apply rules and procedures. By acting and interacting, actors create knowledge, improve mutual awareness, and shape order. Thus, according to the constructionist perspective organisations are constituted as *self-organising learning environments* (Klabbers, 1991).

This logic is the same one as one may find in the simulation literature supporting the implementation of free-format games. Although not all the actor-based approaches found in the organisational design literature conform with such a constructionist stance (given that some researchers are still locked into the contingency paradigm and aim to establish causal relations with structure as the dependent variable), the actor approach is the way forward in organisational design research. It holds much promise especially for integrated and multi-disciplinary research in organisational design and enterprise engineering. The notion of organisations as self-organising learning environments can link up research in the engineering of control tools aimed at giving organisational members feedback on their activities, with the organisational design aspects of providing conditions for more reflexivity to exist within the organisation (Klabbers, 1991). Reflexivity allows self-evaluation to take place and this, in turn, facilitates learning and knowledge creation.

Thus, we suggest that in the age of *ActorWebs* the goal of organisational design should be shifted from a paradigm of "command-and-control" to a paradigm of "connect-and-collaborate", where knowledge creation and sharing are paramount. Tsoukas (1996) talks of organisations as being "distributed knowledge systems" and Boland et al (1994) concur, but go even further by saying that learning in organisations is a process of distributed cognition "whereby individuals construct and reconstruct a system of roles through self-reflection, dialogue and action" (Boland et al, 1994, p. 457). Based on these views, and building on Magalhães (2011) notion of organisational design as a social cognition, we submit that the aim of organisational design as a discipline in the 21st century is "to contribute towards creating richer and richer representations of understanding in all situations of interdependency between individual organisational actors" (Boland et al, 1994). This, in turn, will lead to better "connecting-and-collaborating" capabilities, which will make organisations more responsive (including e.g. regulatory and ethical issues), agile and competitive.

As a concept, organisational design is to be understood as *the planned and emergent rules of interaction which identify any organisation and intervene in the myriad of links between its social and technical elements*. The social elements are behavioural, action-oriented, mostly intangible and not amenable to explicit modelling. The technical elements are the man-made, mostly tangible, elements, which interact with the social ones to form a social-digital-physical whole. This leads to a key tension in the field. The need and the ambition to predict properties of an organisation from a design stance, requires an engineering-inspired approach.

It is important to note that organisational sciences take a much broader view on what organisational design is about than some of the enterprise engineering approaches (Dietz, 2006, 2008) do. Organisational sciences will argue that there are more design related activities happening in organisations than may meet the engineer's eye. Or as Junginger (2015) puts it: "Naturally, they [engineers] are looking for forms and practices of design they are familiar with." Junginger (2015) also states: "Design literally shapes organisational reality." We think this resonates quite well with concepts such as organisational "sensemaking" (Weick, 1995) and the "authoring of organisations" (Taylor, 1996; Taylor and Van Every, 2010, 2004). Junginger (2015) also refers to a similar notion in terms of *design conversations*. The experiences reported by Taylor and Van Every (2004) also point at the fact that a "top down" administrative design of organisations does not work, and that a more distributed understanding of co-authoring is needed. Therefore, in line with the definition of enterprise as being (Meriam–Webster, 2003) *a systematic purposeful activity*, the final aim would be to achieve a continuous dialogue (and design) of the organisation and its enterprises.

The organisational science's understanding of organisational design not only distinguishes itself from the engineering perspective, but should also be separated from a project / programme management view of the world. The way organisational scientists see organisational design is a much more continuous and gradual perspective of change (and re-design) of organisations than project / programme management generally has. The latter view tends to reduce change into a number of discrete and deliberate steps that are executed under explicit managerial control, typically involving an explicit design, construction and implementation activities (be it in a waterfall flow, a more iterative approach, or even an agile approach) based on an engineering mindset.

3 Organisational design and enterprise engineering

In line with the definition of engineering (ECPD, 1947), engineering may contribute to *organisational design* the rigourous application of scientific principles in designing organisations and their enterprises. This would mean that enterprise engineering is a substream within the broader field of organisational design, focusing on evidence based decision making in terms of goals, requirements, constraints, and laws with regard to the design of the enterprises in which an organisation participates. In suggesting this contribution, we do not suggest that all decisions in the context of organisational design should be rationalised/evidence-based. Numerous design decisions will remain implicit, while several decisions will still be made on non-rational grounds. Even more, we also do not suggest that an evidence-based approach should always be applied in a top-down fashion. We rather argue that an engineering perspective can (and indeed should) provide an additional voice in the joint designing/authoring of organisations, be it as part of top-down or bottom-up organisational design activities. We should, however, be aware that not all participants might like, or appreciate, what this voice might be saying about the rationality/sensibility of certain design decisions.

As such, the added value of an engineering approach to organisational design lies in the fact that it enables *informed decision making* (Op 't Land et al, 2008; Harmsen et al, 2009; Proper, 2014) and *informed sensemaking* (Proper and Lankhorst, 2014). In line with the views of Junginger (2015) and Taylor and Van Every (2004), who talk about *design conversations* and *authoring of organisations* respectively, we might want to generalise this to *informed interactions* as part of organisational design activities where, in this case, *informed* refers to evidence-based insight into the design (alternatives) of (relevant parts/aspects of) the organisation and its enterprises, and the *interactions* refers to an evidence-based/rational communicative process (Veldhuijzen van Zanten et al, 2004).

In our view, a model-enabled approach may provide the connection between the world of organisational design and enterprise engineering. Different aspects of an organisation, including its structures, purpose, value proposition, value propositions, business processes, stakeholder goals, information systems, etc, may be captured in terms of (interconnected) models. Just as senior management uses financial modelling to *enable* decision making from a financial perspective, we argue that models of the other parts of an organisation can also enable decision making. Such models can in particular be used to provide insight into the existing situation, the direction in which the organisation is moving, as well as the articulation of the desired future situation and direction (Op 't Land et al, 2008; Jonkers et al, 2011; Proper, 2014). As such, these models enable informed interactions regarding organisational design decision making by all those who are involved in the design processes.

In taking a model-enabled approach it is crucial to acknowledge the potential role of models as boundary objects (Levina and Vaast, 2005; Abraham et al, 2013) in the communication among the different parties involved in organisational design. The concept of boundary objects originated from organisational sciences (Star and Griesemer, 1989). An early approximation of this concept in the world of engineering can be found in terms of *views* and *viewpoints* (Lankhorst et al, 2005) that enable the communication on the design of an organisation (and its different aspects) with different groups of stakeholders (Proper et al, 2012).

As argued in Proper et al (2012), it is important to respect "*the language of the stakeholders*" during such collaborative design sessions. Operationally, this refers to the "informational content" of a model in relation to the stakeholders' concerns, as well as the language (syntax, semantics and pragmatics) used to communicate, as well as the medium used

to communicate/express the model (Proper et al, 2012). The work presented by Proper et al (2012) is actually based on the work by the foundational work of Peirce (1969) and Stamper (1996) and the integration of some of these concepts in Falkenberg et al (1998). As also argued by Abraham et al (2013), the role of boundary objects goes beyond providing a mere view on a consistent "base model", but should rather be seen as being part of a continuous dialogue between the different parties who co-design/co-author the organisation. In section 4 we will discuss some challenges that need to be dealt with when using models as boundary objects, in particular where it concerns the understanding by different groups of stakeholders.

In using models as boundary objects among the different parties involved in organisational design, these models become part (not just the result) of organisational sensemaking processes (Weick, 1995) and the associated authoring processes (Taylor, 1996). Chesley and Wenger (1999) also made an important point about the usefulness of models in fostering a language that enables organisational transformations. These authors discuss the Balanced Scorecard as a framework of models that provides a common, structured environment for executives and employees to have a much better understanding of the company's strategy. They state "learning the vocabulary, discipline, and pace of strategic transformation of any kind is an important step for an organisation, irrespective of the model selected" (Chesley and Wenger, 1999, p. 65).

As a consequence, the vast majority of organisational processes and decisions can be *enabled* by models created from an engineering-based perspective. However, it is also recognised that such an approach must be complemented by an action-oriented or behavioural perspective involving a continuous dialogue (and design) by the organisation of its enterprise. From an organisational design perspective, models are reflections and/or representations of an on-going dialogue. From an enterprise engineering perspective, models are specific design artefacts that have some semantics that allow for specific predictions (within bandwidths of certainty) of properties of the organisation (version) being represented. Models as boundary objects can help us bridge between what De Caluwé and Vermaak (2003) refers to as "blue print" thinking that emphasises an engineering-oriented focus on taking "the right" design decisions based on scientific evidence and principles applied to the design of organisations.

This leads to the point of view that bridging between organisational design and enterprise engineering should start from the observation that models enable the articulation of different designs of the organisation, with the aim to support informed interactions concerning the bottom-up and/or top-down design of an organisation. Such a view is in line with (McKelvey, 1997) proposals towards a "model-centric" organisation science. We propose, however, that the creation of a bridge between organisational design and enterprise engineering should think in terms of model-*enabled* rather than model-*centric* or even model-*oriented*, as it is important to acknowledge the fact that it involves more than models. It is, in particular, important to involve the social, cultural, and political context in which decisions are made (Abraham et al, 2013). Models can only *enable* informed interactions, and become part of the continuous dialogue/authoring that defines organisational design.

4 Challenges for organisational design and enterprise engineering

In this section we discuss some of the key challenges we see facing organisational design and enterprise engineering. Being an editorial, our goal is only to provide an indicative list of challenges, and certainly do not claim to provide a complete list of challenges.

The challenges as discussed below, stem from the recognition that social-digital-physical ActorWebs have an inherent complexity, while at the same time involving many stakeholders with at least as many differing concerns and backgrounds. In discussing the challenges, we also refer to some possible starting points in finding answers to these challenges. They should, however, be regarded as examples and provide inspiration. We certainly do not claim to be complete.

4.1 Organisation and enterprise

It is important to revisit the distinction between organisation and enterprise. The distinction was created within the enterprise architecture/engineering as the result of a belief that the organisation-related (social) sciences have failed to create efficient and effective entities, so-called organisations (Dietz et al, 2013). As discussed in Section 2, amongst other possible perspectives, an organisation can be seen as a grouping of resources (social, digital and/or physical) and activities in pursue a goal or set of goals. Thus, organisation is primarily a social construct that is formed when people interact with one another to perform essential functions that help to attain established goals (Daft, 2007; Kates and Galbraith, 2007). On the other hand, we regard an enterprise as the systematic way an organisation endeavours to achieve (one of) its purposes, in line with the dictionary definition of enterprise ("a systematic purposeful activity" (Meriam–Webster, 2003)).

As such, an organisation can engage in multiple enterprises (together with other organisations). It also means that the notion of organisation should be regarded more from a *sociological* perspective, while the notion of an enterprise (in particular its design) should be regarded more from a *teleological* ("*exhibiting or relating to design or purpose especially in nature"* (Meriam–Webster, 2003)) perspective. The latter also seems to resonate well with the notion of engineering as e.g. suggested when using the term enterprise engineering (Dietz et al, 2013). However, a strict dichotomy between sociological and teleological perspectives can be questioned on the grounds that a sociological perspective can also be teleological. There are several well-known authors in organisational sociology, such as Talcott Parsons, who have built entire approaches to organisational analysis on the basis of systems theory and systemic concepts.

The current situation is that while some researchers firmly believe that organisational design and enterprise engineering should be based on a distinction between organisation and enterprise, others argue that such a distinction is based upon shaky foundations and should be thoroughly revised. A good starting point would be a solid review of literature taking into account not only the conventional literature on organisation theory, but also the more recent literature on entrepreneurship theory (see, for example, Sarasvathy and Venkataraman (2011)).

4.2 Technical complexity

Modern day organisations, being social-digital-physical ActorWebs (Proper, 2001; Proper and Smit, 2001; Proper, 2008) have a high technical complexity in terms of their underlying intelligent technologies. The fact that organisations increasingly take the form of networked organisations (Friedman, 2005; Hagel III and Armstrong, 1997; Camarinha-Matos and Afsarmanesh, 2004; Tapscott et al, 2000; Umar, 2005) adds further to the technical complexity of modern day organisations.

The high complexity also exacerbates the proliferation, and ripple effects, of change. This implies a specific challenge in the sense of finding (model-enabled) ways of harnessing the resulting change complexity.

The question here is to what extent this complexity can, and should, be managed. When combining an organisational design and an enterprise engineering perspective, the question arrises to what extent engineering principles can be applied in harnessing/avoiding these complexities (Huysmans and Verelst, 2013), as well as the question of how models can be used to provide insights into the complexities (Lankhorst, et al., 2012; Op 't Land et al, 2008; Páscoa and Tribolet, 2010).

4.3 Social complexity

Organisational design, and change, processes are (to be) influenced by many stakeholders with different stakes. Conklin (2003) defines this as social complexity, which corresponds as the number and diversity of stakeholders involved in a project/change. The challenge here is to find ways in which models can be used to mitigate between the fragmenting forces (Conklin, 2003). This specifically includes the traditional Business-IT alignment challenge, but, as shown in (Wagter et al, 2012; Wagter, 2013), it is not simply a Business vs. IT issue, and involves differing social forces that spawn social complexity.

The question here is how strategies may be developed to better inform stakeholders in decision making processes, encompassing insights from organisational sensemaking (Weick, 1995, 2001), authoring of organisations (Taylor, 1996; Taylor and Van Every, 2010, 2004), as well as insights from the application of e.g. collaboration engineering (Briggs, 2004) and soft systems methodology (Checkland, 1981) in an organisational design and engineering context (Nabukenya et al, 2011, 2009; Nakakawa et al, 2011, 2013).

4.4 Models as boundary objects

Stating that models can act as boundary objects (Levina and Vaast, 2005; Abraham et al, 2013), and may as such also play a role in bridging between organisational design and enterprise engineering is one thing. However, how to operationalise this in terms of modelling processes, modelling languages, etc, remains a major challenge (Abraham, 2013). Research from the area of collaborative modelling (Vennix, 1996; Persson, 2001; Rouwette and Vennix, 2006; Stirna and Persson, 2007; Stirna and Kirikova, 2008; Barjis et al, 2009; Barjis, 2009; Ssebuggwawo et al, 2013) may also be used as a starting point.

In addition, domain/purpose specific modelling languages (Frank, 2002, 2011; Bjeković et al, 2012) may be used to helps in resolving some of the communicative challenges. However, fundamental issues remain. For example, with regards to joint/shared understanding of the models (Linden et al, 2011), and the tension with regard to the "naturalness" of the languages used to represent/model the organisational designs (Slagter et al, 2012; Moody, 2009, 2006; Zarwin et al, 2014).

4.5 Engaged design and engineering

We argue that models enable informed interaction on the design of the organisation. This, however, immediately triggers the challenge on how to engage the relevant stakeholders

and decision-makers in the informed interaction. For example: *How to ensure that they take ownership of achieving good decisions and committing to the execution of these decisions?*

When using models in the role of boundary objects, it is important to avoid treating them as "passive objects". Potentially they could even be (digital) objects that one can interact with in a tangible way. Experiences from e.g. the EKD researchers (Stirna and Persson, 2007) indicate that the use of e.g. Post-Its and Brown-Paper makes collaborative modelling more engaging to stakeholders than the use of graphical models on computer screens. The potential disadvantage of the use of Post-Its, etc, is of course that the information gathered in this way is not directly available in a useful digital format.

However, when viewing organisations as social-digital-physical ActorWebs, it is natural to also view the design and engineering activities, and modelling processes in particular, as being performed by collaborations of social-digital-physical actors. An example of an approaches in this direction is *participative modelling* Barjis et al (2009) involving the use of tools and technologies to capture complex and advanced interactions. Another example is the concept of *natural modelling* as put forward by Bjeković et al (2013), revolving around the idea of creating modelling environments based on the way humans model "naturally" since the dawn of times. Research using so-called tangible user interfaces, also indicates that it is possible to more effectively mix the social, digital, and physical actors, to better capture (and discuss) designs (Klemmer et al, 2001; Hornecker and Buur, 2006; Haller et al, 2006; Ras et al, 2012; Maquil et al, 2012). Fleischmann et al (2012) have, for example, applied so-called "tangible tables" in the context of business process modelling. Finally, the use of the "game metaphor" (Groenewegen et al, 2010; Ssebuggwawo et al, 2009; Hindriks et al, 2007) to enable the 'playing of games with models' also provides useful starting points to more tangibly engage stakeholders.

4.6 Balancing top-down and bottom-up design

Enterprise architecture (management) tends to take a top-down approach to design activities, where the changes in an organisation (and its enterprises) are guided/directed by an enterprise architecture (Op 't Land et al, 2008; The Open Group, 2011; Greefhorst and Proper, 2011). Winter (2014a,b) provides a nuance to this by suggesting a distinction between *evidence-based* and *emergent* approaches to organisational design. The work by Taylor and Van Every (2010, 2004) also indicates that the "*authoring of organisations*" takes a more bottom-up/emergent approach to organisational design. At the same time, key concerns in an organisation may require top-down measures/direction, to e.g. ensure/enable the realisation of key strategic choices, compliance to regulations, risk management, etc. Therefore, another challenge is to find a good balance between the natural tendency of organisational design to emerge bottom-up and the natural (even though not explicitly intended) tendency of enterprise engineering to take a more top-down perspective.

5 The OD&EE Journal

The OD&EE journal addresses the development of the emerging field of organisational design and enterprise engineering, involving the application and integration of social science, organisation science, communication science, business informatics and computer science research and practice to the study and implementation of new organisational designs, in-

cluding the integrated structuring, modelling, development and deployment of information systems and/or information technology and social processes.

The relationship between organisational scientists and enterprise engineers has always been distant, although a degree of bridging has been achieved by the discipline of information systems. However, in terms of the real world impact, we still see large amounts of money being wasted on applications of information technologies that never fit the needs of organisations. We furthermore have to observe how organisational leaders systematically seem to lose the plot due to their ignorance of the real implications that information technology may have on an organisation's operations and strategy.

In spite of this, organisational reality and the world of information technology continue to move closer together, pushed by unrelenting social, economic and political forces. As a consequence, some are of the view that, in time, the roles of the organisation scientist and of the enterprise engineer will tend to converge and become one and the same.

Such a convergence is part of a broader trend where we find the research area or field of study which we have labelled as organisational design and enterprise engineering. This field can be classified as a sub-discipline of information systems, however it is not restricted to the paradigm or literature of information systems but is manifestly open to influences from social science, organisation science, communication science, business informatics and computer science.

The OD&EE journal addresses the development and integration of organisational design and enterprise engineering, defined as the socio-material entanglement of the "Design" and "Engineering". While "Organisational Design" defines, recommends or uncovers the interactions between organisational actors (human and non-human), in an intertwined fashion, "Enterprise Engineering" improves, streamlines, monitors or changes the nature of such interactions.

The distinguishing features of the OD&EE journal are as follows:

- OD&EE intends to break down the "either-or" mindset which still constitutes a major obstacle to the development of strategic and operational thinking about organisations in the 21st century
- Whereas other journals from computer science or organisational science are aimed solely at their own internal communities, articles from the OD&EE journal aim at establishing bridges between these two communities
- Whereas some information systems journals focus on post-hoc analysis of the deployment or implementation of computer-based artefacts in organisations, the OD&EE journal will show a preference for papers dealing with the intertwined design, construction and change of the assemblages of technology and organisation.

6 Conclusion

This editorial revisited the need for an integrated approach to the design and engineering of organisations and their enterprises. This need is currently even more pressing than ever, with the advent of organisations as social-digital-physical ActorWebs.

We observed how organisational design originates from a social sciences perspective, while enterprise engineering (and its variants such as organisational engineering, enterprise architecture and business engineering) originate from the engineering sciences (most notably information systems engineering, business (process) engineering, business process optimisation, and enterprise architecture).

The OD&EE journal is specifically "built" on the premise that there should not be an "either-or" relation between design and engineering, but rather an integrated approach that brings out the best of the two. Even more we see the "either-or" mindset as being a major obstacle to the development of organisational thinking and this artificial divide must be abolished. The challenges with which modern day organisations are faced with, call for approaches involving a co-design/co-evolution/co-emergence of its social-digital-physical aspects.

In achieving an integration between the organisational design and enterprise engineering, we suggested to take a model-enabled approach, where the word *enabled* plays a crucial role. Models should act as boundary objects between the social processes involved in organisational design processes, and the more analytical/evidence-based side of enterprise engineering, enabling *informed interactions* on an organisation's design.

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