Association for Information Systems
AIS Electronic Library (AISeL)

Research-in-Progress Papers | ECIS 2019 Proceedings

5-15-2019

ATLAS FRAMEWORK FOR INTEGRAL ENTERPRISE MODELLING - INSTANTIATION FOR DYNAMIC CAPABILITIES MODELLING

Mijalche Santa
Ss Cyril and Methodius University, mijalche@santa.mk

Geert Poels
Ghent University, Geert.Poels@UGent.be

ATLAS FRAMEWORK FOR INTEGRAL ENTERPRISE MODELLING - INSTANTIATION FOR DYNAMIC CAPABILITIES MODELLING

Research in Progress

Santa, Mijalche, Ss Cyril and Methodius University, Skopje, North Macedonia and Ghent University, Ghent, Belgium, mijalche@santa.mk

Poels, Geert, Ghent University, Ghent, Belgium, geert.poels@ugent.be

Abstract:

We argue that enterprise modelling should also include the human aspects of the organisation in order to develop a faithful representation of the total relevant system. Faithful representations contribute to practical implementation of management and organisational concepts like dynamic capabilities. Currently, there is a lack of enterprise modelling frameworks for modelling the organization as a socio-technical system. We propose the Atlas Meta Framework for integral enterprise modelling and explain its elements: facets, levels, stakeholders, maps, atlas and roadmap. We demonstrate how the Atlas Meta Framework can be instantiated to the Atlas Capability Governance Framework and an online tool that can be used by managers for orchestrating the second-order dynamic capabilities of an organization.

Keywords: Atlas Meta Framework, Integral Enterprise Modelling, Atlas Capability Governance Framework, Total Relevant System.

1 Introduction

Enterprise modelling is one of the most important activities in Enterprise Engineering and Integration (Sandkuhl et al., 2014a; Vernadat, 2002a). It is more than ever the way to understand the composition and functioning of an organisation and of the information systems used to manage that organisation (Snoeck, 2014). Its purpose is to create an integrated and negotiated model describing different aspects of an enterprise (Persson and Stirna, 2001).

One aspect of enterprises that is gaining attention in organisational studies, but not in enterprise modelling, is the human side of the enterprise, including aspects of learning, value and belief systems, leadership, culture, power, politics and others. On the other hand, current enterprise modelling approaches consider human aspects in a very implicit way, for example, in the Zachman framework (Sowa and Zachman, 1992) it is briefly introduced in the People (who) column but limited to describing motivational aspects (i.e. the architecture vision). These approaches thus constrain the 'enterprise model set' to models suitable for representing the formally planned and designed structure of the organisation (i.e. what is usually considered as the enterprise architecture).

Increasingly, however, the need to take in account the human aspect in organisational issues is explicitly identified (Chan, 2002). Implicit or no representation of the human aspects of the enterprise in enterprise modelling can cause a perceptual distortion and as a result an enterprise model that fails in providing a good baseline for enterprise (re)design. Therefore, within the enterprise modelling discipline, calls to address all relevant aspects of the enterprise are made (Dietz et al., 2013). An appropriate response will be the design of an *integral enterprise modelling approach* that is able to represent all formal and informal socio-technical aspects of the enterprise. Such approach can, for instance, support the implementation of theories like dynamic capabilities and the resource-based view of the firm (Felin and Powell, 2016).

In rapid changing environments, firms need to modify or reinvent their dynamic capabilities to ensure sustained competitive advantage (Schilke, 2014a). This can be achieved through second-order capabilities - capabilities that build and reconfigure first-order dynamic capabilities (Danneels, 2008). However, despite the academic progress, there is still lack of understanding how organisations can put dynamic capabilities into practice (Felin and Powell, 2016). Thus, there is a need for "a coherent framework that can both integrate existing conceptual and empirical knowledge and facilitate prescription (Augier and Teece, 2009)" to orchestrate second-order dynamic capabilities. The envisioned framework requires to represent the explicit and tacit organisational features that support the development of dynamic capabilities. To meet this challenge, there is a need not only for a theoretical framework for the scholars, but also a field-applicable tool that managers can use. An enterprise modelling approach for dynamic capabilities would provide for such tool.

To achieve explicit representation of the human aspects there is a need for a modelling framework which considers the inclusion of the enterprise's socio-technical aspects and their interaction. This framework should minimise the perceptual distortion that current frameworks create and enable the managers to get a realistic enterprise model which they can use for implementation of concepts like dynamic capabilities and the resource-based view.

The goal of this short paper is to demonstrate our proposed *Atlas Meta Framework* for integral enterprise modelling and how it can be instantiated for modelling second-order dynamic capabilities. To achieve this we first present what we mean by human aspects of the organisation (section 2). Then we analyse existing modelling approaches regarding their consideration of human aspects (section 3). In section 4, we introduce the concept of the *Atlas Meta Framework*. Then, in section 5, we demonstrate how the framework can be instantiated for orchestrating second-order dynamic capabilities. Finally, in section 6, we discuss the value of integral modelling for the enterprise modelling field and present our next research activities.

2 Human aspects

Enterprises are complex organisational systems. Historically, the rational approach has dominated their design (Astley and Zajac, 1991). However, it is argued that this approach is essentially oversimplistic in nature and reduces complexity to an easier, simpler structure that does not represent reality (Peszynski and Corbitt, 2006). In this section we aim to provide a brief overview of the human aspects of the enterprise.

One of the most present is *culture*. Although culture is hard to define, there is an understanding that culture has two components: material and ideational (Jermier et al., 1991). The material component consists of more tangible (explicit) symbols (e.g. norms and practice), while the ideational includes the tacit aspects (e.g. assumptions) (Leidner and Kayworth, 2006). This layering on the explicit (visible)/tacit (invisible) spectre is also present in the research of *power*. Power is "elusive concept that not only has surface or visible characteristics, but also hidden characteristics that are difficult to define and grasp" (Jasperson et al., 2002). Furthermore, when analysing the issues of power, we need to take in consideration contextual and structural factors (Krackhardt, 1990).

One of the structural factors is the *organisational structure*. The formal organisational structure tends to reflect the rational considerations regarding the formal administration (Rank, 2008). However, this structure fails to cope with the non-rational dimensions of the organisational behaviour (ibid). Thus, we have the *informal structure*, a relationship-based structure that transcends and complements the formal decision of labour and coordination of tasks (Chan, 2002).

Also, the *learning processes* can be distributed on the explicit-tacit spectre and they can be spontaneous, autonomous-formal and programmed (Janowicz-Panjaitan and Noorderhaven, 2008). Furthermore, for the learning output, *knowledge*, the literature has a consensus that knowledge has an explicit and tacit component and both types are present in the organisation (Smith, 2001). 'We can know more than we can tell' (Polanyi, 2009, p. 4), but we can make our tacit knowledge explicit (Nonaka, 1994). For example, using cognitive maps to represent individuals' view of reality, personal knowledge, and

own experience (Weick and Bougon, 1986 through Ambrosini and Bowman, 2001). Finally, the *control processes* can be formal and informal (Wiener et al., 2015). Where formal control is based on prescribed procedures, and informal control is based on informal social strategies (Keil et al., 2013).

Based on this overview of the human aspects of the enterprise the main conclusion is that the literature recognizes that the different organisational facets can be distributed on a continuum between two points from purely explicit to purely tacit. Furthermore, the literature recognizes that explicit and tacit influence each other and as such they create the total relevant system (Swanson, 1985) that should be modelled. However, there is a lack of structured framework that will provide overview of these interactions. Framework, that will present the formal aspects of the enterprise as rules and characteristics that are openly codified, established and communicated through channels that are widely accepted as official (Helmke and Levitsky, 2004); and the informal aspects defined as socially shared rules and characteristics, usually unwritten, that are created, communicated and enforced outside of official channels, e.g. some workaround that is practiced in the organisation.

The formal and informal aspects are positioned on the spectrum of purely explicit and purely tacit. By knowing the formal and informal aspects the system analyst will be able to ask the right questions, utilise the most appropriate techniques, and generate the best information necessary for effective systems analysis and design (Swanson, 1985). In the next section we evaluate existing enterprise modelling approaches and analyse how they cover the total relevant system (figure 1).

3 Evaluation of existing approaches

Through a period of 40 years of enterprise modelling (Frank, 2014; Vernadat, 2002b) various approaches and methods have been developed. Thus, it is a challenge to identify all the methods used in enterprise modelling and to perform a comprehensive analysis of all of them. To meet this challenge, we used our experience and knowledge of enterprise modelling to make a starting list of mainstream enterprise modelling approaches: MEMO, 4EM, MERODE, EKD, EEML, UEML, BIM, ARIS, and DEMO. Additionally, we included i* and KAOS, requirements engineering approaches that aim to model the organisational or physical systems (Lamsweerde, 2001; Yu et al., 2011). We focused on papers that present and discuss the approach and are written by the approach developers. In this way we get first-hand information about the approach and avoid misunderstandings. To limit our analysis, we next ranked the approaches according to the citations to their papers in the literature by Google Scholar. We then selected the top 5 most cited approaches: Dynamic Essential Modelling of Organisation (DEMO), Multi-perspective enterprise model (MEMO), EEML, For Enterprise Modelling (4EM), Unified Enterprise Modelling Language (UEML), i* and KAOS and analysed how their current usage covers the tacit/informal aspects. Of these 5 approaches, EEML (Krogstie, 2008) and UEML (Vernadat, 2002b) only present a language (i.e. notation). The other 5 approaches are more comprehensive and provide, apart from a language, in an ontology or meta-model and in methodical guidance to construct enterprise models (Table 1).

	DEMO	MEMO	4EM	i*	KAOS
Models	Action Model, Interaction Model, Process Model, Fact Model, Interstriction Model	Strategy Model, Organisation Model, Information System Model	Goals Model, Business Rules Model, Concepts Model, Business Process Model, Actors and Resources Model, Technical Components and Requirements Model	Strategic Dependency model Strategic Rationale Model	Goal model, Responsibility model, Operation model, Object model, Behaviour model
Coverage of tacit	Not present	Not present	in Goals model	in Strategic Rationale	in Goals model

aspects				Model	
Coverage of informal aspects	Not present	Not present	in Goals model	in Strategic Rationale Model	in Goals model

Table 1: Overview of enterprise modelling approaches.

DEMO focuses on business transaction modelling and it has a clear focus on including the formalised explicit aspects of the business transactions (Van Reijswoud et al., 1999). In this direction, the developers of DEMO have decided to exclude the personal world and the expression of psychological or emotional states (Dumay et al., 2005). The reason is that although they are considered 'lubricant in the organisational machinery' they are not directly related to the business at hand (Dietz, 2001). But, as they recognize, Information Systems Development (ISD) is an applied discipline that needs to consider the inherent contradiction of the perspectives of the socio-technical system.

In this direction, MEMO (Frank, 2014) makes an attempt. Through a high-level framework for structuring the enterprise, MEMO introduces two dimensions: perspectives (strategy, organisation, information system) and aspects (resource, structure, process and goal). However, the framework is not used to create an ontological understanding of the enterprise, but for creation of diagram types that will be associated with a set of domain specific modelling languages. Thus, the focus is quickly transferred to the perspectives of engineering of the enterprise model and not so much on the ontological representation of the enterprise. This positions MEMO as an approach for developing Domain-Specific Modelling Languages (DSML) and the appropriate infrastructure to support their use by the analyst/designer.

On the other hand, 4EM makes much more clear description of the elements that it wants to model. It achieves this through six interrelated sub-models (goals, business rules, concepts, business process, actors and resources, and technical components and requirements model) (Sandkuhl et al., 2014b). In the goals model, the authors recognise that the goals can be ambiguously formulated by the stakeholders and they should later on be formalised. Thus, 4EM recognises and includes the tacitness in the goal model. However, the representation of tacitness is limited through the process of goal formalisation and their operationalisation through a business rules model based on explicitly formulated business rules. This formalisation and explicitness is also present in the other models of 4EM.

The importance of the goals in enterprise modelling is recognised decades ago, the most prominent goal-oriented requirements framework being i* and KAOS. KAOS adds an intentional dimension to its models. As such, it is oriented towards behavioural goals and their refinement/conflict links (Lamsweerde, 2009). The goals are formulated using semi-formal specification (Lamsweerde, 2001). This is useful when we explicate high-level, strategic objectives prescribed to agents in software-to-be's environment i.e. organisation and outside stakeholders. These goals are not clear-cut and are treated as expectations on its environment. Although, KAOS builds on an intentional ontology it does not take in account the social ontology.

i* framework builds on social ontology and recognizes that each actor is reasoning from its own perspective. To demonstrate this a Strategic Rationale (SR) model is developed. Through this model i* approach recognizes that models can be "inherently incomplete and may well be inaccurate" due to the beliefs that the actor might have (Yu, 2009 p.7). Belief is a condition that the actor holds to be true and can influence other elements in the model through contribution links. In goal-modeling approaches the beliefs, assumptions, and justifications, are not well investigated, prompting the requirement for further explorations of this organizational aspects (Yu, 2009 p.15).

Based on the above we identified that the tacit and informal aspects are not the focus of analyzed approaches. Starting from DEMO, that purposefully excludes psychological or emotional states than MEMO that focuses more on the perspective of engineering of the enterprise model. On the other hand, 4EM recognizes the tacitness of the goals. The tacitness of the goals is strongly recognized in KAOS and i*. But only i* builds on social ontology. It is the authors of i* (Yu, 2009) that recognize

the limits and challenges of multi view representation of organization, combining viewpoints of different stakeholders, modelling the tacit aspects of beliefs, assumptions and justifications and especially how to collect sufficient data in adequate period of time. In the next section we present our approach to meet these challenges through integral modelling.

4 Atlas Meta Framework

The purpose of the Atlas Meta Framework is to create a faithful integral representation of the enterprise. To achieve this, it combines the following elements: facets, grid, maps, stakeholders and atlas (Figure 2). These elements result from research on enterprises from a learning perspective (Santa and Nurcan, 2016; Santa, 2015), which requires a multilevel understanding of the enterprise, need for continuous change and organisational flexibility, and taking in account the formal/informal and explicit/tacit aspects of the organisation. In this section we present the different framework elements.

The *facets* are particular aspects of the enterprise. Some of them are more tacit like culture, power, politics, and some of them more explicit like structure, processes, technology. Any integral enterprise modelling framework should provide an opportunity for including facets from the entire explicit-tacit spectrum. This is important because if only the visible formal enterprise is modelled, the resulting enterprise model will not be supported by the invisible tacit enterprise and thus not represent the real enterprise.

Merriam Webster Dictionary defines the grid as "a network of uniformly spaced horizontal and perpendicular lines (as for locating points on a map)". The *grid* is a result of the combination of two-level structures:

- Level of analysis
- Level of presence

Level of analysis refers to the hierarchy of aggregation levels at which the enterprise can be analysed (Davidsson and Wiklund, 2001). Regarding the enterprise, it moves from the individual, to teams to aggregates like departments, business units and eventually the enterprise itself, and beyond. Each of these entities is nested in another entity, where the enterprise is also nested in its environment. Thus, the next aggregate levels that can be included are industry, economy, nation etc. Regarding level of presence, we define level as section, of peculiar facet, characterised by a set of inter-locked properties and laws (based on Bunge, 1960). Presence is defined as how much this set of properties and laws is part of a certain level of analysis. For example, how much single-loop learning is practiced by an individual or how much strategies are developed by teams. This is possible by looking on the different facets through the grid as presented in Figure 2.

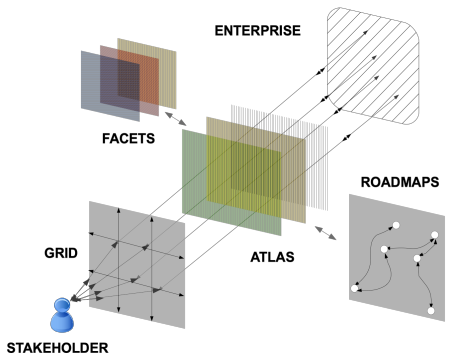

Figure 2: Atlas Meta Framework.

However, we argue that in the organisation there are different stakeholders that have different perception about certain domains. Through the grid we can structure and position their view, but we need to recognise and analyse their view. For, example the executive has a different viewpoint on the same domain from a production line employee. Different types of stakeholders can be employee, manager,

executive, etc. Inclusion of the stakeholder is in line with what other researchers (Frank, 2014; Sandkuhl et al., 2014c) propose that there is a need to identify and represent different stakeholder's perception of the enterprise. In our proposal, we propose this on a concrete individual level and with a more broad domain coverage. We propose that every stakeholder draws its own map of certain facets of the enterprise.

By combining the two grid levels and the stakeholder viewpoints, an in-depth lens is proposed. By looking at the facets through this lens, a number of maps can be created. Each map shows the presence of properties and laws of certain facets at a certain level of analysis as identified as relevant for some stakeholder. The result of this is a number of single maps. The collection of different single maps is what we call the *atlas*.

Through the atlas we can combine different single maps to get a more faithful representation of the enterprise. However, gaining a more faithful representation is not an end in itself. It is only a means to achieve more tangible goals, for example, modelling the orchestration process of building dynamic capabilities by developing a more informed *roadmap* for actions. In the next section we show how the Atlas Meta Framework is instantiated in a dynamic capabilities modelling framework and later in a software tool that can support the orchestration process of building dynamic capabilities.

5 Application to dynamic capabilities modelling

From the introduction of the dynamic capabilities concept it has been argued that the concept is vague and tautological (Prieto and Easterby-Smith, 2006) with a large and complex nomological network (Schilke, 2014b). The dynamic capabilities concept has also been "described mostly as abstract concepts or an elusive "black box" (Pavlou and El Sawy, 2011)". Furthermore, there is still lack of understanding how managers can build dynamic capabilities into practice (Felin and Powell, 2016). It is identified that orchestration of the second-order capabilities can support the creation of appropriate dynamic capabilities. We argue that this can be overcome through instantiation and operationalisation of the Atlas Meta Framework to what we call the *Atlas Capability Governance Framework.*

Orchestration is necessary in order to maintain strategic fit among organisational assets as conditions change (Helfat and Peteraf, 2015). According to Danneels (2008) deliberate investments should be made in organisational features that foster exploration and learning-to-learn. Explicit representation of organisational features that support learning are in detail analysed and identified in learning organisation literature. Based on Santa's literature review (2015) we have structured these organisational features in different facets' properties. Furthermore, we have followed the organisational learning literature and used different levels of learning (Senge, 1990; Argyris, 1999) distributed through learning entities of individual, team and organisation (Giesecke and McNeil, 2004). Finally, based on the learning organization stakeholder analysis (Santa, 2015) we have identified the stakeholders. In Table 2, we demonstrate how the elements of the meta framework are instantiated for modelling second-order dynamic capabilities.

Atlas Meta Framework	**Atlas Capability Governance Framework**
Stakeholders	Employee, Manager, Executive
Level of analysis (X-axis)	Individual, Team, Department, Enterprise, Environment
Level of presence (Y-axis)	Learning levels: None, Incremental, Radical
Facets	Learning; Vision; Strategy; Culture; Power; Structure; Processes; Technology; Leadership; Change.

Table 2: Instantiation of meta elements to Atlas Capability Governance Framework.

The last step is translating the Atlas Capability Governance Framework's elements into tool features (Table 3).

	Tool features	**Purpose**	**Atlas Meta Framework elements**
Front end	User registration	Data collection	Stakeholder; Level of analysis
	Questionnaire		Facets; Level of presence
	Maps	Visualise presence Visualise alignment Drill down data	Facets; Level of analysis; Level of presence
	Atlas		Facets; Level of analysis; Level of presence
	Roadmap	Possible actions	Roadmap
Back end	Statistical calculations	Data analysis	
	Knowledge repository	Actions matching	

Table 3: Instantiation of Atlas Capability Governance Framework in a web tool.

The result is the creation of the *Atlas Capability Governance Framework*, a web-based tool, that managers can use to generate maps for governing their organisation' dynamic capabilities (Figure 3).

The Atlas Capability Governance Framework was applied on four case studies. To generate the maps ten detail questionnaires are prepared, one questionnaire for each facet. A selected number of employees that make an approximate representation of roles and departments in the organisation answer the questionnaire. It takes one employee approximately 40-60 minutes to answer the questionnaire. However, this can be done with large number of employees and as a result in a very short time large quantity of data can be collected. For example, a company with 20000 employees within a day can collect 2000 answered questionnaires. This is not possible with interviews or observation. As the analysis of the data is done in real time, trained person can immediately start interpreting the data (Figure 3) and engage in communication with the organisation's management in development of the roadmap that will enable development of second-order capabilities necessary for achievement of their strategic objectives. Furthermore, by filtering through department or role a better representation of the level of presence can be achieved. For example, we can see that in accounting department we have top-down leadership while in R&D department bottom-up leadership. This enables us to fine-grain the activities that will be performed in different departments or different hierarchical levels.

On the other hand, designer can use the Atlas Meta Framework to instantiate it to a different domain than second-order capabilities. For example, in direction of explicating tacit and informal aspects in business model development (Osterwalder and Pigneur, 2012) or on more transdisciplinary issues like One Health (Rüegg et al., 2018). This is possible because the meta framework provides a flexibility to introduce new facets and using the grid to get in-depth understanding of those facets. Furthermore, it is scalable and can minimize the problems identified in the other modelling approaches.

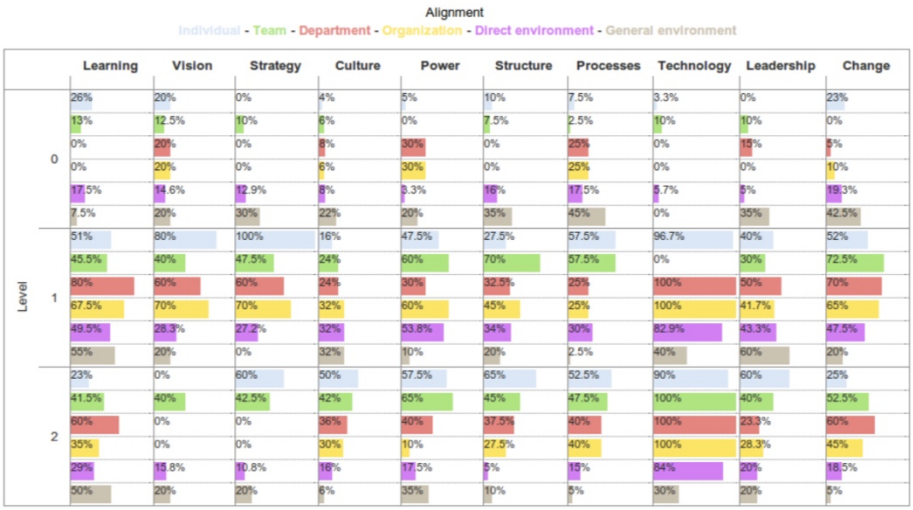

Figure 3: The atlas overview as a result of using Atlas Capability Governance Framework

6 Discussion

This research-in-progress paper argues that enterprise modelling needs to move into the direction of integral modelling which will provide a more faithful representation of the organisation as a socio-technical system. Our main contributions are introduction of the Atlas Meta Framework as one approach for integral modelling and its instantiation to Atlas Capability Governance Framework for orchestration of second-order dynamic capabilities. These contributions are possible through use of a novel approach of modelling that disentangles the socio-technical organisational system and reorganises it in a system of maps that can be combined to get a better understanding of the organisation. Furthermore, by developing a meta framework we provide an opportunity for additional instantiation of the framework to other organisational issues.

By instantiation of the meta framework to Atlas Capability Governance Framework we aim to demonstrate the value of integral modelling. Orchestration of second-order dynamic capabilities for a long period is a challenge in the management and organisational studies, because it includes tacit and explicit organisational aspects. Now, we provide a framework and tool that provides a solution to this challenge. Thus, integral modelling is important not only for scholars but also for practitioners. By demonstrating this value, we hope to question the main assumptions about what should be modelled by enterprise modelling scholars. With these results in mind and the value provided, it can be assumed that in the future integral modelling approaches could provide an advantage over approaches focusing on modelling only certain parts of the organisations. Furthermore, we believe that integral modelling will contribute to the development of frameworks and tools for theories and approaches in management and organisational science. Thus, further demonstrating the importance of enterprise modelling.

The next step in our research is empirical validation of the Atlas Capability Governance Framework through academic and business focus groups.

References

Ambrosini, V. and Bowman, C. (2001), "Tacit Knowledge: Some Suggestions for Operationalization", *Journal of Management Studies*, Vol. 38 No. 6, pp. 811–829.

Astley, W.G. and Zajac, E.J. (1991), "Intraorganizational Power and Organizational Design: Reconciling Rational and Coalitional Models of Organization", *Organization Science*, Vol. 2 No. 4, pp. 399–411.

Argyris, C. (1999), *On Organizational Learning*, 2nd ed., Wiley-Blackwell.

Augier, M. and Teece, D.J. (2009), "Dynamic Capabilities and the Role of Managers in Business Strategy and Economic Performance", *Organization Science*, Vol. 20 No. 2, pp. 410–421.

Bunge, M. (1960), "Levels: A Semantical Preliminary", *The Review of Metaphysics*, Vol. 13 No. 3, pp. 396–406.

Chan, Y.E. (2002), "Why haven't we mastered alignment? The importance of the informal organization structure", *MIS Quarterly Executive*, Vol. 1 No. 2, pp. 97–112.

Danneels, E. (2008), "Organizational antecedents of second-order competences", *Strategic Management Journal*, Vol. 29 No. 5, pp. 519–543.

Davidsson, P. and Wiklund, J. (2001), "Levels of analysis in entrepreneurship research: Current research practice and suggestions for the future", *Entrepreneurship Theory and Practice*, Vol. 25 No. 4, pp. 81–100.

Dietz, J.L., Hoogervorst, J.A., Albani, A., Aveiro, D., Babkin, E., Barjis, J., Caetano, A., et al. (2013), "The discipline of enterprise engineering", *International Journal of Organisational Design and Engineering*, Vol. 3 No. 1, pp. 86–114.

Dietz, J.L.G. (2001), "DEMO: Towards a discipline of organisation engineering", *European Journal of Operational Research*, Vol. 128 No. 2, pp. 351–363.

Dumay, M., Dietz, J.L.G., Mulder, J.B.F., Goldhuhl, G., Lind, M. and Haraldson, S. (2005), "Evaluation of DEMO and the Language/Action Perspective after 10 years of experience", *Proceedings of LAP*, available at:

https://www.researchgate.net/profile/Jan_Dietz/publication/228608492_Evaluation_of_DEMO_and_the_LanguageAction_Perspective_after_10_years_of_experience/links/00b7d5194882bea202000000.pdf (accessed 22 June 2017).

Felin, T. and Powell, T.C. (2016), "Designing Organizations for Dynamic Capabilities , Designing Organizations for Dynamic Capabilities", *California Management Review*, Vol. 58 No. 4, pp. 78–96.

Frank, U. (2014), "Multi-perspective enterprise modeling: foundational concepts, prospects and future research challenges", *Software & Systems Modeling*, Vol. 13 No. 3, pp. 941–962.

Giesecke, J. and McNeil, B. (2004), "Transitioning to the Learning Organization", *Library Trends*, Vol. 53 No. 1, p. 54.

Helfat, C.E. and Peteraf, M.A. (2015), "Managerial cognitive capabilities and the microfoundations of dynamic capabilities", *Strategic Management Journal*, Vol. 36 No. 6, pp. 831–850.

Helmke, G. and Levitsky, S. (2004), "Informal Institutions and Comparative Politics: A Research Agenda", *Perspectives on Politics*, Vol. 2 No. 04, pp. 725–740.

Janowicz-Panjaitan, M. and Noorderhaven, N.G. (2008), "Formal and informal interorganizational learning within strategic alliances", *Research Policy*, Vol. 37 No. 8, pp. 1337–1355.

Jasperson, '.(., Carte, T.A., Saunders, C.S., Butler, B.S., Croes, H.J.P. and Zheng, W. (2002), "Review: Power and Information Technology Research: A Metatriangulation Review", *MIS Quarterly*, Vol. 26 No. 4, pp. 397–459.

Jermier, J.M., Slocum, J.W., Fry, L.W. and Gaines, J. (1991), "Organizational Subcultures in a Soft Bureaucracy: Resistance behind the Myth and Facade of an Official Culture", *Organization Science*, Vol. 2 No. 2, pp. 170–194.

Keil, M., Rai, A. and Liu, S. (2013), "How user risk and requirements risk moderate the effects of formal and informal control on the process performance of IT projects", *European Journal of Information Systems*, Vol. 22 No. 6, pp. 650–672.

Krackhardt, D. (1990), "Assessing the Political Landscape: Structure, Cognition, and Power in Organizations", *Administrative Science Quarterly*, Vol. 35 No. 2, pp. 342–369.

Krogstie, J. (2008), "Using EEML for Combined Goal and Process Oriented Modeling: A Case Study", in *Proceedings of EMMSAD*, p. 113.

Lamsweerde, A. van. (2001), "Goal-oriented requirements engineering: a guided tour", in *Proceedings Fifth IEEE International Symposium on Requirements Engineering*, presented at the Proceedings Fifth IEEE International Symposium on Requirements Engineering, pp. 249–262.

Lamsweerde, A. van. (2009), *Requirements Engineering: From System Goals to UML Models to Software Specifications*, Wiley, Chichester.

Leidner, D.E. and Kayworth, T. (2006), "Review: A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Culture Conflict", *MIS Q.*, Vol. 30 No. 2, pp. 357–399.

Nonaka, I. (1994), "A Dynamic Theory of Organizational Knowledge Creation", *Organization Science*, Vol. 5 No. 1, pp. 14–37.

Osterwalder, A. and Pigneur, Y. (2012), "Designing Business Models and Similar Strategic Objects: The Contribution of IS", *Journal of the Association for Information Systems*, Vol. 14 No. 5.

Pavlou, P.A. and El Sawy, O.A. (2011), "Understanding the Elusive Black Box of Dynamic Capabilities", *Decision Sciences*, Vol. 42 No. 1, pp. 239–273.

Persson, A. and Stirna, J. (2001), "Why Enterprise Modelling? An Explorative Study into Current Practice", in Dittrich, K.R., Geppert, A. and Norrie, M.C. (Eds.), *Advanced Information Systems Engineering*, Springer Berlin Heidelberg, pp. 465–468.

Peszynski, K.J. and Corbitt, B.J. (2006), "Politics, Complexity, and Systems Implementation Critically Exposing Power", *Social Science Computer Review*, Vol. 24 No. 3, pp. 326–341.

Polanyi, M. (2009), *The Tacit Dimension*, University of Chicago Press, Chicago; London.

Prieto, I.M. and Easterby-Smith, M. (2006), "Dynamic capabilities and the role of organizational knowledge: an exploration", *European Journal of Information Systems*, Vol. 15 No. 5, pp. 500–510.

Rank, O.N. (2008), "Formal structures and informal networks: Structural analysis in organizations", *Scandinavian Journal of Management*, Vol. 24 No. 2, pp. 145–161.
Rüegg, S.R., Nielsen, L.R., Buttigieg, S.C., Santa, M., Aragrande, M., Canali, M., Ehlinger, T., et al. (2018), "A Systems Approach to Evaluate One Health Initiatives", *Frontiers in Veterinary Science*, Vol. 5.
Sandkuhl, K., Stirna, J., Persson, A. and Wißotzki, M. (2014a), *Enterprise Modeling - Tackling Business Challenges with the 4EM Method*, Springer Berlin Heidelberg, Berlin, Heidelberg.
Sandkuhl, K., Stirna, J., Persson, A. and Wißotzki, M. (2014b), "Overview of the 4EM Method", in *Enterprise Modeling*, Springer Berlin Heidelberg, pp. 75–86.
Sandkuhl, K., Stirna, J., Persson, A. and Wißotzki, M. (2014c), "Sub-models of 4EM", in *Enterprise Modeling*, Springer Berlin Heidelberg, pp. 87–147.
Santa, M. (2014), *Framework For Multivariate Continuous Transformation Towards Learning Organization*, phdthesis, University Paris 1 - Pantheon - Sorbonne, 17 December, available at: https://tel.archives-ouvertes.fr/tel-01140416/document (accessed 10 May 2016).
Santa, M. (2015), "Learning organisation review – a 'good' theory perspective", *The Learning Organization*, Vol. 22 No. 5, pp. 242–270.
Santa, M. and Nurcan, S. (2016), "Learning organization modelling patterns", *Knowledge Management Research & Practice*, Vol. 14 No. 1, pp. 106–125.
Schilke, O. (2014a), "Second-Order Dynamic Capabilities: How Do They Matter?", *The Academy of Management Perspectives*, Vol. 28 No. 4, pp. 368–380.
Schilke, O. (2014b), "On the contingent value of dynamic capabilities for competitive advantage: The nonlinear moderating effect of environmental dynamism", *Strategic Management Journal*, Vol. 35 No. 2, pp. 179–203.
Senge, P.M. (1990), *The Fifth Discipline: The Art and Practice of the Learning Organization*, 1st ed., Doubleday Business.
Smith, E.A. (2001), "The role of tacit and explicit knowledge in the workplace", *Journal of Knowledge Management*, Vol. 5 No. 4, pp. 311–321.
Snoeck, M. (2014), "Enterprise Modelling", in *Enterprise Information Systems Engineering*, Springer International Publishing, pp. 3–30.
Sowa, J. and Zachman, J. (1992), "Extending and formalizing the framework for information systems architecture", *IBM Systems Journal*, Vol. 31 No. 3, pp. 590–616.
Swanson, N.E. (1985), "Power: A critical systems development factor", *Information & Management*, Vol. 9 No. 4, pp. 209–213.
Van Reijswoud, V.E., Mulder, H.B.F. and Dietz, J.L.G. (1999), "Communicative action-based business process and information systems modelling with DEMO", *Information Systems Journal*, Vol. 9 No. 2, pp. 117–138.
Vernadat, F. (2002a), "Enterprise modeling and integration (EMI): Current status and research perspectives", *Annual Reviews in Control*, Vol. 26 No. 1, pp. 15–25.
Vernadat, F. (2002b), "UEML: Towards a unified enterprise modelling language", *International Journal of Production Research*, Vol. 40 No. 17, pp. 4309–4321.
Wiener, M., Remus, U., Heumann, J. and Mähring, M. (2015), "The effective promotion of informal control in information systems offshoring projects", *European Journal of Information Systems*, Vol. 24 No. 6, pp. 569–587.
Yu, E. (2009), "Social Modeling and i*", in Borgida, A.T., Chaudhri, V., Giorgini, P. and Yu, E. (Eds.), *Conceptual Modeling: Foundations and Applications: Essays in Honor of John Mylopoulos*, Springer-Verlag, Berlin Heidelberg, pp. 99–121.
Yu, E.S.K., Giorgini, P., Maiden, N. and Mylopoulos, J. (Eds.). (2011), *Social Modeling for Requirements Engineering*, MIT Press, Cambridge, Mass.