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Frederick Benaben, Francois B. Vernadat

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Information System agility to support collaborative organisations

Collaborative networks, extended enterprises and all kinds of structured groups of collaborative organisations are ways to help enterprises and organisations to cope with competitiveness and performance expectations in nowadays business ecosystems (Camarinha-Matos and Afsarmanesh 2005). Although there are a lot of variables and changing elements to be considered in collaborative organisations (in terms of variety of forms, geographical distribution or variety of approaches), their life cycle is quite classical and stable (Camarinha-Matos et al. 2009). It includes:

- **Creation:** deals with partner selection, collaborative objective definition, structural constitution and start-up.
- **Operation:** concerns execution of collaborative behaviour (classically business processes) to reach the common objectives.
- **Evolution:** means that the collaborative network may have to perform an adaptation based on its native flexibility or plasticity. Such adaptation concerns change at membership, role or activity levels.
- **Metamorphosis:** implies a deeper adaptation that cannot be managed natively, for instance, due to dysfunction or situational changes. These evolutions imply the need to redesign the collaboration.
- **Dissolution:** concerns the end of the collaboration.

These collaborative network life cycle steps show that there are at least two types of adaptation that can happen in collaboration of organisations. One is supposed to be managed by the intrinsic flexibility of the network, while the second implies to rearrange it. These are indeed two implementations of the notion of agility. Thus, questions to be addressed include: How to deal with new collaborative objectives? How to deal with new contextual events? How to deal with dysfunctions? How to deal with unexpected unavailability of resources? How to deal with partners leaving or joining the network?, etc.

As explained by Camarinha-Matos et al. (2009), the success of collaboration between organisations depends on the quality of information management all along the life cycle. Information systems are on one hand the external interface of organisations (by providing a formal entry point to any partner) and on the other hand the operational backbone of organisations (managing data, applications and workflows).

Consequently, managing the ability of information systems (and IT systems supporting them) to perform features supporting the aforementioned steps of the collaborative network life cycle (namely evolution and metamorphosis steps) is nowadays a prerequisite. Thus, there are two main questions that need to be considered:

- (1) **What does the information system of a collaborative network look like?**
- (2) **What is the definition of agility of such information systems?**

If we first focus on the **first question**, an organisation may be defined as a set of *functions* providing capabilities, fed by *information* as inputs and organised according to *processes* describing the behaviour of the organisation. *Functions* may be offered by machines, software applications, people or any resources able to provide the organisation with a service. *Information* may be any

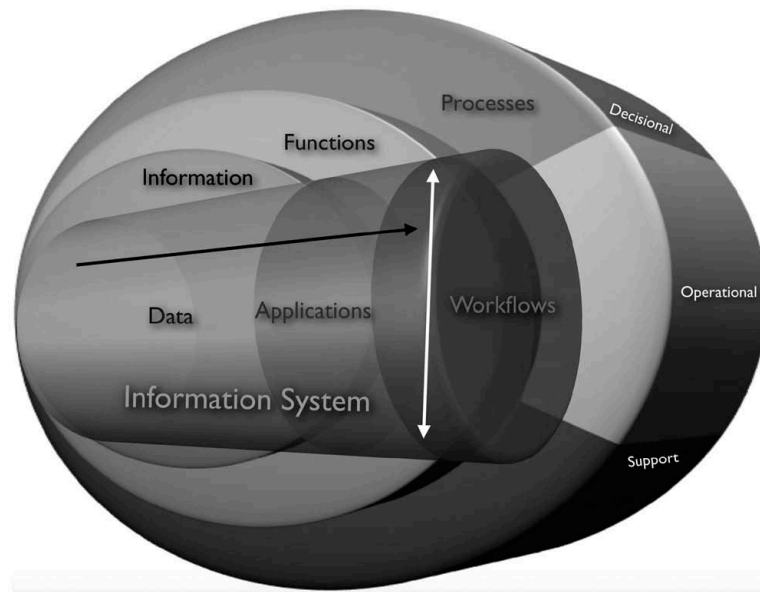


Figure 1. A vision of the structure of an organisation and of the role of the information system.

piece of knowledge representing static or dynamic elements about the organisation and its environment. *Processes* are made of behavioural formalisation, activity description or structure of allocated actions dedicated to achieve the goals of the organisation. In addition, *processes* invoke *functions* to perform activities, while *functions* are using, creating and updating *information*. Consequently, the optimal information system would cover these three layers of abstraction with *information* managed as *data*, *functions* managed as *services* and *processes* managed as *workflows*. Historically, information systems have been improving in a horizontal way (see the black arrow of Figure 1) and used to focus first on *information* management (early information systems were mostly based on database management systems), then on the integration of *functions* (through Electronic Data Interchange or Common Object Request Broker Architecture, for instances) and finally *process* management (with workflow engines). Furthermore, nowadays the maturity level of information systems is increasing in a vertical way (see the white arrow of Figure 1) and leading them to cover *information* space (with *data*), *function* space (with *services*) and *process* space (with *workflows*) as much as possible.

Consequently, the information system of a collaborative network must be able to manage these abstraction levels and should perform interoperability for *data messages*, *services* and *workflows* with respect to the following structuring layers:

- **Information:** Collaborative information systems should be able to manage transfer and translation of *data*.
- **Functions:** Collaborative information systems should be able to manage access to *services* from partners.
- **Processes:** Collaborative information systems should be able to orchestrate collaborative *workflows*.

To reach these expectations, there may be a lot of logical and technical architectures (from integration and standardisation to low coupling and systems of systems). Anyway, the information systems dedicated to support collaborative organisations should be able to provide these three interoperability functions (Figure 2).

Considering the **second question**, there are a lot of definitions of agility of a system. Kidd (1994), Lindberg (1990) or Sharifi and Zhang (1999) drew the line between agility and the concepts of reactivity, flexibility and adaptability. There are finally four main aspects to this vision: the system

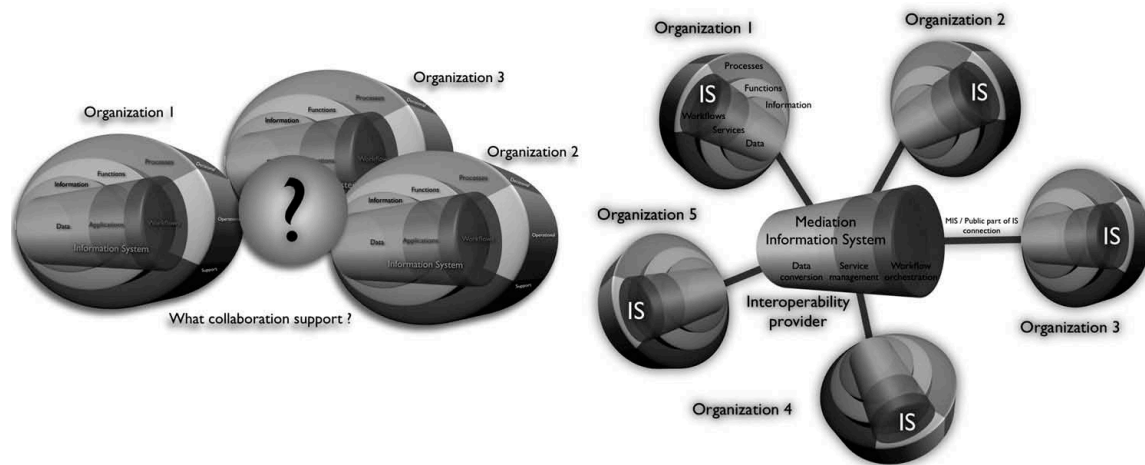


Figure 2. Key functions of collaborative information system (data, service and workflow levels).

must be able to decide to change its structure (adaptability) and actually to change its structure (flexibility) but this should be done in a time frame relevant within the considered dynamic context (reactivity) and according to an accurate analysis (efficiency).

In the context of this special issue, these four facets of agility have been considered with respect to two orders: the first order represents the main components of agility while the second order concerns the features of these main components (Benaben et al. 2015). Consequently, agility may be defined, on the first order, as the capacity of a system to (i) detect any (potentially unexpected) situation that requires the system to change and (ii) adapt its global structure/behaviour to that situation. Regarding the second order, two other attributes may be considered: first, the dynamicity of agility might be crucial (performing detection and adaptation too slowly disrupt agility) and, second, the relevance of the detection and adaptation may also be critical (i.e. wrong detection and adaptation could be fatal for the significance of agility). Therefore, this vision may be simply and roughly formulated as:

$$\text{Agility} = (\text{detection} + \text{adaptation}) \times (\text{reactivity} + \text{efficiency}).$$

Such a formula, although not scientific at all, is a structuring scheme that allows the study of agility to be partitioned along these four properties. Finally, *detection* and *adaptation* may be considered as the main attributes of agility (first order) while *reactivity* and *efficiency* are the attributes of detection and adaptation (second order).

Considering agility in the scope of information systems, *reactivity* and *efficiency* are mainly performance features that should be considered through the perspective of logical/technological architectures. *Detection* and *adaptation* (as first order characteristics) are more significant and could be considered from a scientific perspective. Actually, on the one hand, *detection* is a very interesting concept as far as it may cover the range from *anticipation* to *reaction*. Besides, *detection* may be based on very early events, signals or any other forms of usable signs (tending thus to *anticipation*). *Detection* may also be based on later events or waiting for trustable proof of the need to adapt (providing this *reaction*). On the other hand, *adaptation* is a maturity proof, allowing a system to use means to change what it is (nature, behaviour, role or any other characteristics) to evolve in a context different from continuous operation. There are plenty of approaches to provide a system with the *adaptation* ability: structural flexibility, reconfiguration feature, autodiagnosis, open and evolving upgradeable structure, etc.

This special issue is made up of four articles dedicated to explore the question of agility of information systems to support collaborative organisations in accordance with the previous elements. The philosophy, approach and methodology taken by these papers are directly or indirectly related to the exploration of agility of information systems in collaborative contexts. These papers will appear in the following order:

The first paper, 'Concurrent Enterprise: A conceptual framework for enterprise supply chain network activities', provides a conceptual framework that could be helpful to structure the domain of agility of collaborative networks dealing with integrated product development. The framework is developed in a supply chain environment and is proposed as an extension to the SCOR reference model.

The second paper, 'Social media as an information system: Improving the technological agility', empirically tests the Honeycomb model as a tool that enhances the technological agility of social media. The paper concerns structuring the domain of agility at the social media strategy formation level.

The third paper, 'Modelling and simulating a crisis management system: An organisational perspective' provides an organisational analysis of the context of reactive interaction and collaboration among several cooperating entities. The environment for crisis management is modelled using a multi-agent system and lends itself to simulation.

The last paper 'A viewpoint-based case-based reasoning approach utilising an Enterprise Architecture Ontology for experience management' focuses on knowledge capitalisation from past experiences in project management to support agile activities. The novelty of the paper concerns the integration of an enterprise ontology into a CBR (Case Based Reasoning) approach and the addition of the concepts of view and viewpoint to the CBR approach.

Finally, the ability of an enterprise to create or take part in collaboration is no longer an order winner. This is now an order qualifier. Information systems, viewed as the functional, structural and technological backbone of organisations, play a dominant role in this situation and must be able to support the efficiency of collaborative networks. Agility of these information systems is eventually a key feature that should be considered as a primary requirement and a major research and development topic.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Frederick Benaben
University of Toulouse, Mines Albi, France
✉ frederick.benaben@mines-albi.fr

François B. Vernadat
LGIPM, University of Lorraine, Metz, France
✉ francois.vernadat30@gmail.com