Towards Performance Modeling for Collaborative Enterprises

Barbara Livieri[1], Mario Bochicchio[2]

University of Salento
[1]Department of Economic Sciences
[2]Department of Innovation Engineering
{barbara.livieri,mario.bochicchio}@unisalento.it

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1 Introduction and Scenario

Globalization forced businesses to rearrange their organizational structures and focus on flexible forms of collaboration. In this work, we focus on collaboration from a systemic perspective [16,13]; in order to emphasize this view on collaboration and to abstract from the specific forms that it can assume, we use the term collaborative enterprise (CE).

Research and empirical studies [1,9] suggest that collaborative enterprises need specialized tools to support performance management and decision-making processes, by enabling a clear linkage between strategic goals and Key Performance Indicators (KPIs). Indeed, the continuous monitoring of the fulfillment of goals is a critical factor in determining the success of CE [6,8]. The achievement of this result poses several challenges that are not common or less relevant in individual organizations.

On one hand, interoperability issues need to be accounted for. Indeed, different organizations often use different terms to describe the same concept or the same term to refer to different concepts (semantic heterogeneity), use different data structures in their information systems [11] (structural heterogeneity) or apply diverse data formats (syntactic heterogeneity). This is sometimes due to different accounting standards and methods.

On the other hand, in order to better link strategic goals to KPIs, a context-based recommender system for performance indicators could facilitate the decision of which performance to use, thus offering a more comprehensive perspective and, based on the achieved performance, help managers in taking strategic decisions. The recommender system should suggest relevant KPIs and possible dashboards starting from the information on the collaborative enterprise's and the participants' goal system and from the collaboration type. Indeed, each actor and CE has a goal system - explicitly or implicitly formulated - and can use a set of metrics to monitor the goal achievement. These metrics should also be linked with the role of each participant and to the resources used to perform the required activities. On the other hand, the performance measurement system

cannot abstract from the peculiarities of collaborative enterprises and from the specific types of collaboration.

After an analysis of literature, it resulted that while the research on interoperability has broadly analyzed the heterogeneity aspect [14], other issues are still open. In particular, although sever modeling approaches for performance measurement already exist, most of these models are difficult to reuse, since they are developed for specific and different purposes. At the same time, there is a lack of a shared understanding on what collaboration is and on the types and forms of collaboration.

In the following, we will describe in more detail these two issues and propose a possible solution.

2 CE modeling

The literature on collaboration is vast and multidisciplinary, thus sometimes it lacks of coherence in the definition and understanding of collaboration. In particular, there are two aspects that lead to a different definition or classification of collaboration.

First, sometimes the same term is used to describe different concepts or, on turn, the same concept is described by means of different terms. For instance, the term "alliance" is sometimes referred indistinctly to both horizontal or vertical partnerships [15], while is often used only to describe vertical alliances and sometimes only dyadic relations, which accordingly to [2] should not be considered as alliances. The same goes for the term "joint venture", which sometimes is regarded as one of the possible types of alliances [7,15] and sometimes as a different concepts [5].

Second, in order to classify the collaboration types, different authors refers to different perspectives (e.g., temporal, geographical, integration type, goal-related and so on). Even when the same perspective is used, it can result in a different classification or in a classification that refers to different meaning of the term "collaboration", as above mentioned.

For these reasons, a conceptual model, that enables to clarify what collaborative enterprises are, which are their features, how they behave and which are the forms they assume, should be developed. In order to achieve this goal, there is the need to look at the literature on collaboration, to identify the different definitions of the collaboration, the classifications already available and their definitions. This should to identify the main concepts and their mutual relations. By looking at [10], which provides a list of classifying variables, some concepts, such as business sector, resource, actor and role, already emerge.

A CE has a structure consisting out of actors (i.e., the individual organizations) [3], their roles and the relationships between them (e.g., sharing or client-supplier). Each actor owns some resources (tangible, intangible and human), which are needed in order to exploit a role and the related responsibilities. In order to evaluate the reachability of goals and the potential value creation

and exchange, there is the need to estimate whether the resources owned by the partners are apt to fulfill their roles.

3 Performance Modeling

After a review of literature, it emerged that several approaches on performance modeling already exist in literature [12]. However, most of these models are originated with very different purposes or belong to different categories of modeling techniques, making them application-related and difficult to reuse. A core model can be created starting from the existing ones through integration. The choice of the integration activity (merge, composition and weaving) to apply to each specific part of the analyzed models is determined by the relationship which holds between the models [4]. In order to understand the inter-model relations, a structural and semantic comparison of the performance indicators models is needed. In particular, a) we analyze the inter-model relationships that hold between individual models in order to decide about the integration approach most suitable for each modeling element and b) we identified the connection between these models and the aims/modeling techniques, allowing us to identify constructs strictly related to the application scenario and that should consequently be left out from a domain model.

In particular, we identified the semantic differences connected to the use of synonyms or related to different objects of analysis (i.e., the whole organization or a process). Indeed, although there are not explicit structural difference - since all models are defined at an high-level - the different conceptualization brings to an implicit one, which needs to be accounted for in the integration process.

In the case in which the concepts are overlapping, but are represented from different perspectives, it is possible to apply merging techniques. For instance, in the case of the classes related to performance indicators, it should be possible to guarantee different synonyms for the concept (e.g., indicator, KPI, etc.) and to adopt the most general meaning. In this sense, the classes related to the process indicator should be merged at lower hierarchical levels, thus not losing any informational content. Indeed, opting for the more specific class (process indicators) would mean to conceptualize only a part of the reality and, therefore, to leave out the more-general domain related classification. The same goes for the concept of goal, defined as organizational goal, and the one related to the process goal, as well as for the concepts of resource, capability and competency and for the distinction between the formula as an attribute and the formula as a class. In the first two cases, the more general concept - goal, as a construct that can be assigned to specific objects, and resource - should be preferred as upper concepts, whilst the concepts of organizational goal, process goal, competency and capability should be modeled at a lower level. In the second case, it should be preferred the modeling choice that enables the inclusion of more information and that can enable information integration, thus formula as a class.

On the other hand, for what concerns the non overlapping concepts, a distinction is needed. On one side, there are the concepts that are specific of a

model but that are not strictly related to the category of modeling techniques; these concepts should be included in the domain model. Although these classes are connected to the aim of the models, they enhance the understanding of the domain and the re-usability of the model itself. On the other hand, concepts strictly related to the modeling techniques should not be included, since these concepts could not be easily re-used, because they are mainly connected to the application scenario.

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