Quality Measures for Digital Business Ecosystems Formation

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Abstract. To execute a complex business task, business entities may need to collaborate with each other as individually they may not have the capability or willingness to perform the task on its own. Such collaboration can be seen implemented in digital business ecosystems in the form of simple coalitions using multi-agent systems or by employing Electronic Institutions. A major challenge is choosing optimal partners who will deliver the agreed commitments, and act in the coalition's interest. Business entities are scaled according to their quality level. Determining the quality of previously unknown business entities and predicting the quality of such an entity in a dynamic environment are crucial issues in Business Ecosystems. A comprehensive quality management system grounded in the concepts of Trust and Reputation can help address these issues.

Keywords: Business Ecosystems, Quality measures, Quality dynamics, Trust and Reputation.

1 Introduction

Business activities are inherently complex in nature. These activities may involve more than one entity (business entity) forming a coalition or an alliance with multiple other business entities in order to deliver objectives. Business entities, specifically SMEs, may collaborate (or form an alliance between themselves) in order to carry out these complex tasks. No single SME by itself would have the necessary resources and infrastructure in order to carry out complex activities. This may lead to the formation of a business ecosystem where more than one SME may work with other SMEs in order to achieve a pre-defined objective or goal. In such an environment, SMEs are interdependent to carry out a task [1]. Of crucial importance in such a setting is to find the appropriate partners for the business interaction along with the management of the business relationships. With widespread adoption and support of the internet and related technologies, physical Business Ecosystems can now function as Digital Business Ecosystems in order to collaborate on a virtual basis. So far, Business Ecosystems are practically implemented through several approaches, from simple concepts of coalitions using multi-agents systems [2] to a more normative form of

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Electronic Institutions [3]. The formation of Business Ecosystems, either through simple coalitions or Electronic Institutions, generally follow two approaches being either cooperative (beneficial to all the entities) or competitive (non-cooperative) [4]. Coalition formation algorithms can be classified into static and dynamic [5]. Static approaches are those that do not allow for possible changes to the membership of the coalition due to the emergence of new information while this is possible in dynamic approaches. The concept of 'dynamics' can also be found in Electronic Institutions [6]. To undertake digital business ecosystems, negotiation plays an important role in both the approaches of coalitions and Electronic Institutions. The negotiation protocols, which are crucial in the formation of Business Ecosystems, can be classified into pre-negotiation and post-negotiation [7]. In pre-negotiation protocol, the negotiation with the suppliers or providers is done before the coalition forms. In each approach of business collaboration (regardless of its nature), the underlying crucial issue is the selection of appropriate partners to ensure successful outcomes. During the negotiation phase, compromises and subsequent agreements are made on the payoffs and their distribution. However, the overall quality of the entities involved in the collaborative task execution along with the quality of the coalitions needs to be modelled precisely taking into account all relevant factors. The challenges increase, especially in a dynamic environment, where it is very important to maintain and monitor the quality of each entity along with the entire coalition.

2 Quality Related Issues

The coalition formation process may consist of two steps [8]. In the first step a task is determined and in the second step agents are selected for task completion. In a multi-agents system the agent, typically, first determines their values for all coalition (reward), second, the agent rank and select their preferences and in the end the coalition member internally distributes the expected revenue [9]. But the key concern, when forming a business alliance is the quality of the participating entities [10]. The increasing demand of users for high quality (QoS) and timely information is putting businesses under increasing pressure to update their knowledge and identify new ways for collaborating with their peers [11]. A multi-objective, optimisation, evolutionary algorithm enables an agent to choose an optimal set of agents with whom a coalition can form for a particular task, which is called a coalition calculation [12].

Here, the optimal set of agents definitely means the agents having high quality in terms of their service. It is believed to be absolutely crucial that no compromises be made in quality of the entities and coalitions themselves, which helps to address problems like uncertain future behaviour, operational breakdowns and unexpected output of the entities and coalitions. It is also strongly believe that this is only possible when entities have opportunities in selecting customised quality levels as every coalition may not need the same quality level for the business interaction in a business ecosystem. It will help to address the issues discussed in the following section.

3 Approach

The success and failure of a business ecosystem is directly linked to the quality of the entities in delivering on the predefined objectives. So far, negotiation protocols are

used to enable agents to negotiate and form coalitions by providing them with simple heuristics for choosing coalitions partners. These protocol and heuristics allow the agents to form coalitions in the face of time constraints and incomplete information [4]. The crucial issue, at this stage, is not the incompleteness of information about the entities but being able to reliably determine the quality of entities for which there may be limited relevant information. In such a scenario, the quality of that entity needs to be determined through available information taking into account the semantic gap between that information and the relevant information for quality purposes. As a result, such assessments of the quality of such entities that have either little or no relevant previous information (for determining quality), can be made and this would not disadvantage them adversely, thereby solving the cold-start issue. A comprehensive mechanism, before the negotiation process, that is capable of determining the quality of such entities joining the business ecosystems would be beneficial. It is a risky decision to consider such unqualified entities for the coalition formation and particularly for the business ecosystem. This will lead to the problems mentioned in the previous section.

In today's dynamic world where the necessities and opportunities are changing rigorously, entities may find better opportunities in the future or such environmental changes may affect their quality in the future. These dynamics play an important role in the completion of tasks and the fate of the ecosystems. In order to deliver on the predefined objective, agreed upon at the time of ecosystem formation, the dynamic nature of quality at the point of time in the future needs to be predicted. This will help to prepare optimised agreements during the negotiation process [10].

Time is considered as the core factor of dynamics in quality. Other factors are dependent on the time that can be useful in predicting the quality of the entities or the entire coalition. One such time-dependent factor that can help predict the quality of entity, or the entire coalition, is the maturity of the entities. Considering the maturity of the entities or business ecosystem itself can help in prediction and also reduce the complexity in computing the future values for the quality.

4 Conclusion

The success and failure of a business ecosystem is directly linked to the quality of the entities in delivering the predefined objectives. No compromise should be made in determining the quality of the entities and coalitions themselves in a business ecosystem. Measures should be developed to deal with problems like uncertain future behaviour, operation breakdowns and unexpected outputs of the entities and coalitions. It is only possible when entities have opportunities in selecting customised quality levels.

To deal with the issues discussed in previous sections and to enable such quality control mechanisms, the role of trust and reputation cannot be ignored. Trust and Reputation are well known in creating environments especially virtual environments in which prosperous businesses and communities work confidently. Reputation plays great importance in enabling trusted business interactions. Trust and reputation are indispensable and pivotal for regulation based on quality. Normally trust and reputation are used successfully in building architectures for quality management.

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