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On inter-organizational trust engineering in networked collaborations : modeling and management of rational trust

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Chapter 7

Conclusion, validation, lessons learned and future work

7.1   Introduction

This chapter presents a summary of the achieved results and concludes the thesis. It first briefly presents how and where in the thesis the research questions introduced in Section 1.5 are addressed and reflects on the achievements of our research in relation to the research objectives. The chapter then addresses the evaluation and validation of our proposed solutions and concepts. Finally, the chapter concludes with a discussion of the lessons learned and proposes three directives for the future work in this area.

7.2   Reflection on research findings

Each main research question presented in Section 1.5 corresponds to one or more chapters in the thesis. In this section we briefly summarize answers to each research question and how they contributed to achieving our research objectives.

7.2.1   Reflection on responses to the research questions

MRQ1: How the diversities in the purposes for which trust among organizations need to be established (from trustor to trustee) as well as trustor's concerns and preferences can be handled?
Generally, the set of trust criteria applied to assess the level of trust in an organization may differ among different trust objectives due to dissimilar perceptions and preferences on trust among trustor organizations. As explained in Chapters 5 and 6 the preference of a trustor organization influences its selection of trust criteria to apply in assessing the level of trust in trustee organizations. Thus it is not possible to generalize for all trustors the selection of the set of trust criteria for all cases of trust establishment between organizations.

MRQ2: How can the understanding of many elements and concepts related to rational trust within a VBE be supported for its stakeholders?
In Chapter 4, we have presented models of trust relationships between organizations. These models are developed for the purpose of supporting organizations in achieving a common

understanding of concepts related to inter-organizational trust. By assisting organizations in gaining insight into inter-organizational trust, the proposed models will enable these organizations make knowledgeable and informed decisions on trusting others. In Section 4.3, we have proposed the *ontology-based formalism* that supports organizations in achieving and maintaining common understanding about the fundamental concepts of inter-organizational trust.

MRQ3: How can formal mechanisms be developed to rationally assess and formally reason about the level of trust in organizations?

The level of trust in an organization can neither be measured with a single trust criterion nor interpreted with a single metric. A multi-criteria approach is proposed in this thesis for assessing the organization's level of trust in VBEs. The thesis proposes the HICI approach for systematically identifying and characterizing fact-based trust criteria for organizations, as presented in Section 3.2. The HICI approach is applied to identify a large general set of trust criteria for organizations as presented in Section 3.3, validated by experts in the area to be comprehensive.

On the basis of the characterized trust criteria we have proposed mathematical formulas for assessing the level of trust in the organization. The suggested mechanism applies analysis of causal influences among the trust criteria, the known factors and the intermediate factors to generate these formulas, as presented in Chapter 5. As such, we have shown that the level of trust in an organization can be measured in terms of a series of fact-based trust criteria. Furthermore, the perceptions of trust differ between organizations which in turn influence the trustors' preferences regarding which trust criteria to apply in assessing trustees' level of trust. Therefore, as proposed in this thesis the mechanisms for assessing trust level of an organization must be customizable to apply the set of trust criteria preferred by the trustor. Trustor organizations can also use these mathematical equations to rationally reason on the accuracy of the results of the assessment of the level of trust in trustee organizations.

MRQ4: How can the establishment of inter-organizational trust relationships in VBEs be facilitated?

A number of systematic steps must be followed to establish sustainable inter-organizational trust relationships and for this purpose, as presented in Section 2.5, guiding steps are proposed. As proposed in these steps the management of inter-organizational trust as addressed in Chapter 6 is required to controlling the balance of levels of trust among organizations in the VBE. TrustMan system is designed on the basis on of the Service Oriented Architecture (SOA) and in particular web service standards. The applied SOA standards enhance the replicability, adaptability and sustainability of TrustMan system in different application environments.

As addressed in Chapter 2, there are also other fundamental related issues that need to be properly considered and analyzed while establishing trust relationships between organizations, including: the analysis of possible risks associated with trust relationships between organizations (addressed in Section 2.3.5) and the validation of the trust-related data that is used to assess the level of trust in organizations (addressed in Section 2.4).

7.2.2   Reflection on achievement of research objectives

Based on the addressed research questions mentioned in Section 7.2.1, we can state that both research objectives of RO1 and RO2 stated in Section 1.5 of the thesis are achieved as described below.

RO1: To properly support the management of trust aspects in VBE, providing generic and comprehensive "concepts, approaches, mechanisms and models" needed for supporting:
        o *Common understanding of the aspects relating to rational trust,*
        o *Assessment of organizations' level of trust,*
        o *Creation of inter-organizational trust,*
        o *Establishment of trust relationships between organizations".*

In this thesis we have characterized the inter-organizational trust addressing among other aspects: the identification of fact-based trust elements for organizations, the modeling of trust relationships between organizations, the assessment of trust level of an organization, and support for the establishment of trust relationships between organizations. The research objective – RO1 – is achieved by answering research questions MRQ1, MRQ2, and MRQ3, as summarized in Section 7.2.1.

RO2: Providing a validated prototype implementation for a trust management system in VBEs in order to assist organizations in achieving various trust-related objectives.

The analysis, design, implementation and operation of the TrustMan system are addressed in detail in Chapter 6. The TrustMan system provides services supporting the tasks related to management of trust between organizations in VBEs. The approach applied to the development of TrustMan system and the set of considered aspects provide the response to the main research question MRQ4 as summarized in Section 7.2.1. We have achieved the RO2, in relation to the development of TrustMan system, by: identifying a number of potential users, analyzing users' requirements, specifying functionalities and services, and designing system architectures and user interfaces, as summarized in Section 7.2.1.

7.3   Evaluation and validation of research results

This section presents the evaluation of our research findings. First, it describes the approaches followed to validate our research findings. Second, it addresses the empirical validation performed by VBE networks. Third, it presents the validation of TrustMan system with standard indicators and against other related systems. Finally, it presents the validation of our research findings within the scientific community.

7.3.1   General evaluation approaches

In science, we are keen to evaluate our achieved results and the steps we followed to produce the results. For a standard software development project the evaluation focuses on measuring key aspects of results such as products, processes, and resources and then use this information to determine whether we have met our goals such as: productivity, performance, quality and other desirable attributes [Pfleeger, 2001]. But there are many possible evaluation techniques to choose from, and it is important to understand which one(s) are most appropriate for an application. For this research, we have chosen the approaches suggested by Pfleeger [Pfleeger, 2001] to evaluate our findings against the following four techniques:

✦ *Case study*: This technique is particularly useful in depicting a holistic portrayal of a client's experiences and results regarding a system. Case studies are used to organize a wide range of information about a case and then analyze the contents by seeking patterns and themes in the data and by further analysis through cross comparison with other cases. A case (under study) can be related to individuals, programs, or any unit, depending on what the program evaluators want to examine through in-depth analysis and comparison. Most case studies involve the use of quantitative indicators. We have applied this technique to perform an

empirical evaluation of TrustMan system with quantitative indicators as further addressed in Section 7.3.3.

⟡   *Feature analysis*: This technique is primary used to rate and rank the attribute of a developed software product, in order to evaluate whether it is innovative on basis of specific standards or against other products. As presented in Section 7.3.4, we have applied this technique to evaluate and validate our developed research results on the bases of standard indicators as inspired by ISO 9126. We have also applied this technique to evaluate our results within the scientific community as further addressed in Section 7.3.5.

⟡   *Survey*: This technique is primarily a retrospective study to try to document expectations and outcomes in given situations. Surveys are often done in social sciences, where attitudes are polled to determine how population feels about a particular set of issues, or a demographer surveys a population to determine trends and relationships. In computer science, surveys are very similar to that, we record information to determine how project participants and other stakeholders reacted to a particular method, tool, or technique. We have also applied this technique to perform an empirical evaluation of our results with qualitative indicators as addressed in Section 7.3.3.

⟡   *Formal experiment*: This technique is used when values of some independent but representative variables are manipulated, and we observe changes in dependent variables, in order to determine how changes in the input affect changes in the output. This technique is mostly applied to evaluate the effectiveness and accuracy of algorithms. Considering that our research is not focused on testing algorithms, we did not apply this technique to evaluate our achieved results.

7.3.2   Validation of our achieved results

A fundamental step guiding us during our research was related to the validation of our resulted findings. We have successfully validated our research findings, using the three techniques mentioned above, namely: empirical validation, feature analysis (with standard indicators and within research community), survey (empirical validation with qualitative indicators), and case study (empirical validation with quantitative indicators), presented in Section 7.3.1 as follows:

⟡ *Experimentation in running industrial VBE networks* (*Empirical validation*): Our research aimed at providing innovative solutions to support the management of inter-organizational trust in VBE networks. As part of the research requirement specification, a number of VBE's requirements (presented in Chapter 1) related to the management of inter-organizational trust were identified and analyzed. To validate our research findings against these identified VBE's requirements, our proposed solutions were tested by four running VBE networks during the ECOLEAD project. This empirical validation task focused on evaluating the innovativeness of the conceptual results and software prototypical results (in line with "*the case study*" technique). The empirical validation of our research findings is presented in Section 7.3.3.

⟡ *Validation with standard indicators and against other systems* (*self validation*): In parallel to performing the empirical validation, another step was to analyze whether our proposed solutions are developed following scientific approaches and standards. Therefore, we have validated our prototypical result (the TrustMan) applying scientific indicators and against other

existing related trust management systems. This validation process (in line with "*the feature analysis*" technique) is presented in Section 7.3.4.

Validation within scientific community *(peer reviewed validation)*: Also in parallel, we focused on consultation with other experts in the area of inter-organizational trust management to collect suggestions, comments, etc., for the purpose of validating our achieved results. This validation process (in line with "*the feature analysis*" technique) also heavily focused on presenting and publishing our research findings in scientifically and internationally accepted channels in related areas as presented in Section 7.3.5.

7.3.3   Empirical validation – Achievements in relation to VBE requirements

Our research findings are classified into two main categories, namely: the conceptual results including methodologies, mechanisms, approaches, etc., and the prototypical results including the TrustMan system and its set of developed functionality. These achieved results were tried and experimented within four industrial VBE networks for the purpose of validation against the requirements related to management of inter-organizational trust. The VBE networks that participated in validating the findings include: the Swiss Microtech (SMT), the ISOIN, the Cebenetwork (CBN), and the IECOS (see their descriptions in Annex C). These empirical evaluation and validation of our results was performed applying a set of *qualitative indicators* to evaluate their level of innovation, reliability, usability, and expectation, as well as a set of *quantitative indicators* to evaluate the needed resource and time.

A: With qualitative indicators

To qualitatively validate the research findings some questionnaires (see Annex C) were developed in order to collect empirical evaluation results from the above four industrial VBE networks. Figure 7.1 shows a bar chart representing these results and more specifically the generalized picture regarding the validation and acceptance of the proposed research findings and developments by these VBE networks. The numbers shown in Figure 7.1 represent scores referred to as the level of acceptance of our research findings by the VBE networks. These scores are computed on the basis of quantitative values obtained for each qualitative indicator mentioned in this section. The quantitative values of indicators are obtained by mapping the applied qualitative grading schemes into some range of numbers. This mapping and the analysis of evaluation results of our research findings with qualitative indicators is addressed in Section 6.6.2, and summarized in Table 6.7. The score of: 3 represents strong acceptance, 1.5 represents average acceptance, and 0 represents the poor acceptance.
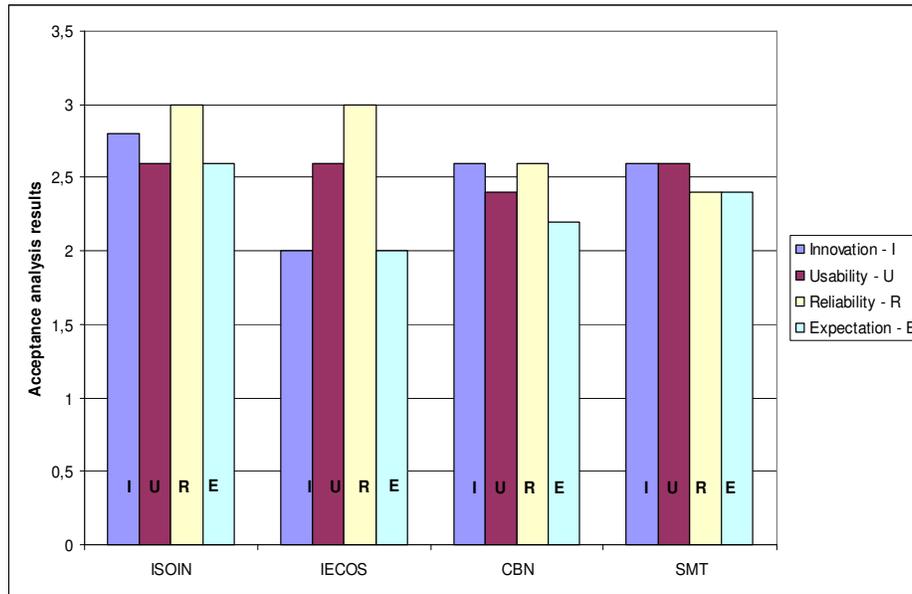
Figure 7.1: Empirical validation of research findings with qualitative indicators by VBE networks

This figure shows the results of evaluation both the conceptual and prototypical results produced by TrustMan system applying several qualitative indicators. The conversion of qualitative indicators to numbers and their computations whose results are indicated in this graph is presented in Section 6.6.2.

B: With quantitative indicators

To quantitatively evaluate our research findings each VBE estimated their reduction of time and resource, in terms of a percentage, after applying our solutions in performing the processes related to management of inter-organizational trust. In Section 6.6.2 we present and analyze the processes that were performed by the VBEs with support of services provided by TrustMan system. The average percentage of reduction on the amount of the resources consumed and the time spent for the tested processes is shown in Figure 7.2. The quantitative analysis related to empirical validation of our developed results is presented in Section 6.6.2.

As shown in Figure 7.1 and Figure 7.2 and also on the basis of the analysis presented in Section 6.6.2, we can conclude that both the conceptual results and the software prototypical result produced by this research are validated, very well accepted and directly applicable to the industrial VBE networks. Furthermore, based on these positive empirical evaluation results we can also conclude that VBE's requirements related to management of inter-organizational trust as stated in Section 1.4 are properly addressed by this thesis.
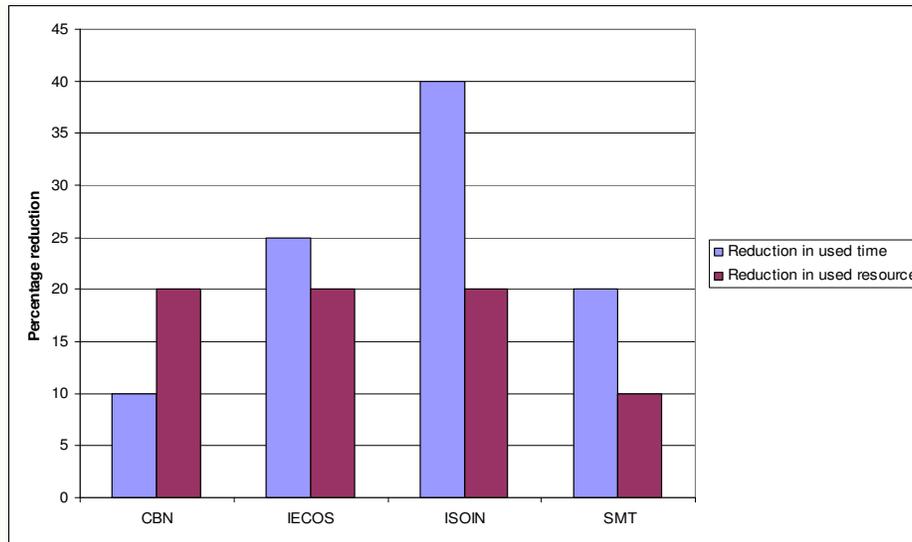
Figure 7.2: Quantitative evaluation of developed results by VBE networks

This figure shows the results of evaluation of the TrustMan system applying quantitative indicators. The detailed analysis is presented in Section 6.6.2.

7.3.4   Self validation – With standard indicators and against other systems

In this thesis, to evaluate the quality and the level of innovation of the proposed conceptual and prototypical solutions we have applied a set of indicators inspired by *ISO 9126 quality factors of software*. For each of the six categories presented in Figure 7.3 a number of more specific indicators are defined. With these indicators we have validated the TrustMan against five other related trust management systems as mentioned below.
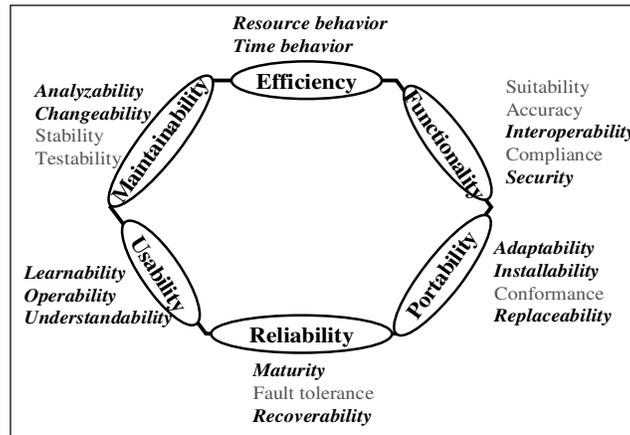

Figure 7.3: Evaluation indicators inspired by ISO 9126 quality factor of software products

This figure shows the standard indicators for evaluating software as inspired by ISO 9126. The bold indicators were applied for evaluating the TrustMan system.

Indicators shown in Figure 7.3 with italic and bold font type are selected by us as most applicable for our validation purpose applied for evaluating the TrustMan system against the following five related systems which are further described in Annex B:

1. *DRACO (COMARCH, Poland):* This is a commercial system supporting the evaluation of trust level of organizations that aim at forming a collaborative consortium. The assessment of trust level of the potential partners is based on the security level of systems owned by trustee organizations which will be applied to facilitate the collaboration.
2. *okCupid (www.okcupid.com):* This is a freeware online system supporting the analysis of trust of individuals for the purpose of creating an online community. The analysis of trust is based on comparisons of individuals' profiles against the profile of the owner of the community.
3. *Trusted Advisors Associates (http://trustedadvisor.com/):* This is a freeware online system supporting individual self assessment of trustworthiness by answering a set of questions.
4. *Trust assessment wheel (http://www.darden.virginia.edu/faculty/james.htm):* This is an online research prototype system supporting analysis of trust among students for the purpose of co-working in group work. It is based on a set of guidance and criteria organized in wheel.
5. *Truster (http://www.truster.org/):* This is a freeware online system, based on online unique identifications (such as email addresses) supporting the analysis of trust of individuals on the basis of their performance data from different online sites.

The detailed definitions of applied indicators, as shown in Figure 7.3 and Figure 7.4, are provided in Annex B.
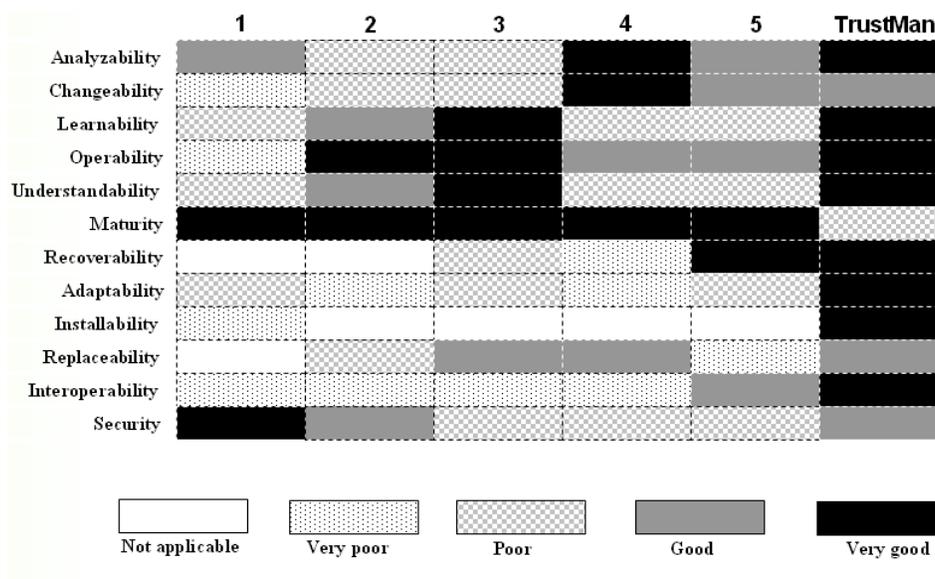

Figure 7.4: Evaluation of TrustMan system with scientific indicators
This figure shows the evaluation results for the TrustMan system with standard indicators and against other systems as further addressed in Annex B.

Figure 7.4 shows a summary of evaluation results of TrustMan system with the above mentioned scientific indicators and against the five mentioned systems each shown by their specific number above. We have one by one tested the features of these five systems in comparisons with the TrustMan system. As shown in Figure 7.4, although this is a self-test, our results show that on most tested features the TrustMan system score better than other related systems for the applied validation indicators. The interpretation and comparison of some example rows of Figure 7.4 is presented in Annex B.

7.3.5   Peer reviewed validation – Within scientific community

To validate our research findings within the scientific community we have focused on achieving as many high quality publications as possible, addressing different subjects related to management of inter-organizational trust in VBEs. The Table 1.2 shown in Section 1.7 presents the three fundamental subjects (SB1, SB2 and SB3) related to inter-organizational trust, as classified in this thesis and summarized in Figure 1.3, namely:

SB1: *Requirement analysis and specification of the management of inter-organizational trust*
SB2: *Modeling and designing mechanisms for assessing level of trust in organizations*
SB3: *Developing a system supporting the management of trust between organizations*

Achievements of this research in relation to these three subjects can be illustrated through the acceptance of our results within the scientific community, considering the number of publications appeared in high quality channels, including: *journal articles, book chapters, and peer reviewed international conference proceedings*. Figure 7.5 represents the current status of publications that have contributed to this thesis in relation to each off these three subjects. A complete set of the author's publications is presented in Annex A.
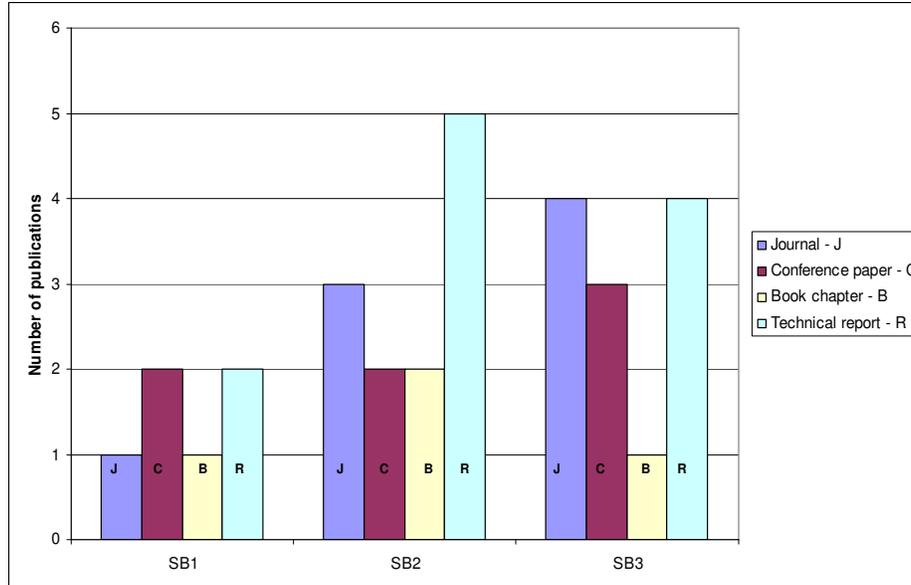

Figure 7.5: Status of publications achieved by the author related to this thesis per subject
See the complete list of publication achieved by the authors in Annex A.

7.4   Lessons learned and future work

Performing research goes hand-in-hand with gaining new insight into the addressed subject. However, while increasing the insight into the subject there are always discovery of some new challenges that may go beyond the conditions set for research, such as the time, resources, availability of data and knowledge, etc. Such challenges, which therefore, cannot be addressed by the research, form the foundation or basis for future work. A few crucial lessons that we have learned during this research are addressed in this section as suggestions for future work in the area of management of inter-organizational trust.

7.4.1   Inter-organizational trust: lessons learned

The fundamental lessons we have learned during this research can be classified into five categories, namely related to: (a) Emerging definition of inter-organizational trust in VBEs, (b) Identification and characterization of fact-based trust elements for organizations participating in VBEs, (c) Measurement of the level of trust in organizations in VBEs, (d) Management of inter-organizational trust in VBEs, and (e) Establishment of inter-organizational trust relationships in VBEs. These lessons that we have learned in relation to each of the above five categories are described below.

a)   Related to emerging definition of inter-organizational trust in VBEs

We have learned that there is no consensus yet on the definition of trust both in the research community and in business practice. This means that it is hard to find common understanding among people or organizations about what trust means across different disciplines of research and practice. By means of requirement analysis, literature study, expert consultations, and empirical study of VBE networks, we have realized that it is challenging to formulate a concrete definition for organizational trust that can address its measurement criteria and cover its fundamental aspects while being applicable to all domains of the VBE networks.

We have ascertained that the level of trust in organizations needs to be measured rationally. Thus the definition of trust must also address some fundamental rational concepts that can support reasoning about its measurements. We have provided a definition of inter-organizational trust as presented in Chapter 1 that incorporates fundamental rational aspects of trust in VBEs. The main challenge related to establishing the definition of rational trust is to convince different stakeholders to alter their current definition of this concept, which typically – within their traditional practice and especially among individuals – is considered to be a very subjective aspect. Therefore, it is challenging to convince trust actors to accept the current emerging definition of trust, considering its rational aspects as well as the formal mechanisms for analyzing trust in organizations.

b)   Related to identification of fact-based trust elements for organizations participating in VBEs

We have learned that the identification of fact-based trust elements for organizations cannot be efficiently achieved in an ad hoc manner. For trust related studies, the trust elements for organizations in VBEs must be first systematically identified and characterized to ensure that a

comprehensive set is achieved that can be then customized and applied to different VBEs. In Chapter 3, we have presented the HICI approach, which provides systematic stages that can be followed to identify, characterize and analyze trust criteria related to organizational performance data. We have also learned that the identified trust criteria might need to be tuned over a certain period of time, depending on some changes in the VBEs' requirements that are related to the management of inter-organizational trust.

c)   Related to the measurement of level of trust in organizations in VBEs

We have learned that the level of trust in an organization can neither be measured with a single parameter, such as a trust criterion, nor interpreted with a single metric. As characterized in our research, the level of trust in organizations is measured in terms of a set of trust criteria selected by a trustor organization, depending on that organization's preferences and perception of trust. In order to facilitate the multi-criteria measurement of the level of trust in organizations, certain key aspects need to be addressed, including: the identification of relevant trust elements for organizations, the modeling of trust relationships between organizations, and the formulation of mechanisms for assessing the level of trust in organizations, as addressed in Chapters 3 and 5 of the thesis.

d)   Related to the management of inter-organizational trust in VBEs

We have learned that the tasks related to the management of trust between organizations in VBEs need to be developed as a subsystem of the VBE management system. This is due to the fact that the current manual processes for trust assessment practiced in industry are becoming increasingly inefficient, mostly subjective and require analysis of large amount of complex data to accomplish them. In dynamic markets these processes must be performed quickly and thus need to benefit from the support of advanced ICT systems.

We have addressed the design and development of tasks related to the management of inter-organizational trust by proposing the TrustMan system. Among other functionality, the TrustMan system shall support the assessment of the level of trust in organizations. However, the final decision regarding trusting other organizations is always made by the trustor organizations. The TrustMan system also supports handling tasks related to managing inter-organizational trust in VBEs. It shall provide trustor organizations, such as the VBE administrator, with properly analyzed and compiled information related to the trust history of VBE member organizations in order to support the trustor in making informed decision.

e)   Related to the need for systematic steps for Establishing Trust Relationships among organizations in VBEs

We have learned that the establishment of trust relationships between organizations must be systematic and well organized, and thus detailing every aspect, including the preceding and proceeding steps. We have learned that there is a need for a framework to guide the establishment of trust relationships between organizations. For this purpose, in Section 2.5 we proposed a set of ordered steps needed to guide the establishment of inter-organizational trust relationships. For each proposed step a supporting service is developed in the TrustMan system as addressed in Chapter 6.

7.4.2   Inter-organizational trust: future work

Sufficient research has supported the current achieved conclusions, but it will never be enough to address future conclusions. Such future conclusions require further research in the future. Nevertheless, same future research topics can be defined in the conclusions of the current work. Despite the extensive findings presented in this thesis, the subject of management of inter-organizational trust still has many open challenges that need to be addressed. We can suggest the following four topics for future work in this area.

a)   Analyzing statistical correlation for the use of trust criteria in VBEs

Certain characteristics of the society and market might influence trustor organizations on their selection of trust criteria that are used to assess the level of trust in trustee organizations. For example, if an organization is doing business in a very socially-oriented community then adhering to social values of that society may seem more important than achieving healthy profits. However, in such a community there is an obvious risk of economic failure, such as failing to achieve the needed economic profit to survive. Thus, the trustor may need help to properly identify the needed criteria for trusting others. It is very difficult in general to predict or even analyze which trust criteria to use at the VBE for each trust objective.

Nevertheless, when some trust criteria have been in use in the VBE, in relation to certain objectives, for a relatively long period, this data can be recorded in the VBE. Furthermore, collected empirical data related to trustee's performance at the VBE and/or VOs can indicate if choosing certain trust criteria by the trustor instead of certain other trust criteria proves to be a good indicator of organizations' trustworthiness.

Furthermore, certain trust criteria may not often be selected by trustor organizations. If this trend arises, it will discourage trustee organizations to pay attention to those less frequently selected trust criteria and thus they will not enhance their performance related to those trust criteria. However, this does not mean that those trust criteria may never be selected in the future. That means if they are selected, they might lower the trustworthiness of certain organizations, and may thus present an unexpected or uncommon organization's trust picture. It is in general unclear when and how these patterns relating to the selection of trust criteria by trustors will occur.

Predictive studies or analysis of statistical correlations based on empirical data can support defining some indicators for the above example cases. Further research needs to be carried out addressing the above two aspects.

b)   Complementing fact-based trust analysis with opinion-based trust analysis

In Section 2.3.4 we discussed and distinguished the concepts of rational trust and subjective trust. This thesis addresses the research on rational trust for supporting the realization of trust between organizations on the basis of their fact-based data. There are however, a number of key practical challenges related to the application of rational trust analysis approaches in business. The following challenge has been identified to need further research:

Acquiring trust related-data on time: In our approach, the level of trust in an organization is rationally measured on the basis of a set of trust criteria. This means that updated trust related data for all preferred trust criteria must be available in order for the trust level of an

organization to be computed. In practice, however, when the amount of required trust related data increases, it may be hard to collect this data from organizations in time. Therefore, other complementary approaches, such as a subjective trust assessment approach can be considered in the event that trust-related data are missing for application of our rational approach.

Opinion-based approaches apply subjective data, such as reputation, to assess the trustworthiness of organizations. Although the base concepts of the two approaches, one rational and one opinion-based for analyzing trust differ the opinion-based approach may complement the rational-based approach when fact–based data are missing. In future research, when a new approach is introduced on how the results from rational trust analysis can be complemented with the results from subjective trust analysis, then the assessment results of the TrustMan system can be augmented with the results from other subjective systems.

Furthermore, in future, other systems may be developed supporting rational analysis of inter-organizational trust that may be used by some VBE organizations. For example, if some trust data of an organization related to one trust perspective of the TrustMan system is missing while another trust assessment system can compute the related scores for that trust perspective, then it may be possible to integrate those scores within the TrustMan system in order to provide a complete assessment of the trust level of the organization. In other cases, both TrustMan system and another trust assessment system might for example both generate some scores for certain trust perspectives, which may be also considered by TrustMan system. In either case, first the scores from another system shall be normalized according to the boundaries of scores generated by the TrustMan system, and second, the trustor organization shall set the weights for how it values the scores from each system.

c) Exploiting VBE-related trust concepts in PVC environments

PVCs (Professional Virtual Communities) are analogous environments to the VBEs, as they both have many similarities being long-term strategic alliances that focus on preparing their members for future involvement in potential short-term collaboration. A fundamental difference between VBE and PVC however is their members; while VBEs comprise of organizations, PVCs consist of individuals.

This thesis addresses inter-organizational trust to support cooperation in VBEs and collaboration in VOs that are configured within VBEs. Although inter-organizational trust and inter-personal trust have been clearly shown to differ, as addressed in Section 2.2.1, the base approach introduced for inter-organizational rational trust establishment as applied in VBEs have the potential to be also applied for PVCs, which opens up a new challenge in need for further research.

To conclude, in this work we have shown that trust is a fundamental aspect in facilitating and smoothing goal-specific collaboration among organizations. As such, trust among organizations needs to be properly created applying rationally assessed trustworthiness. A number of challenges, as addressed in this thesis, need to be properly addressed to support the rational assessment of trust level of organizations, for which this thesis has contributed to solve.