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Inter-organizational Success Factors: A Cause and Effect Model

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Abstract Inter-organizational systems form the basis for successful business collaboration in the Internet and B2B e-commerce era. To properly design and manage such systems one needs to understand the structure and dynamics of the relationships between organizations. The evaluation of such inter-organizational relationships (IORs) is normally conducted using "success factors". These are often referred to as constructs, such as trust and information sharing. In strategic management and performance analysis, different methods are employed for evaluating business performance and strategies, such as the Balanced Scorecard (BSC) method. The BSC utilizes success factors for measuring and monitoring IORs against business strategies. For these reasons, a thorough understanding of success factors, the relationships between them, as well as their relationship to business strategies is required. In other words, understanding success factors allows strategists deriving measurements for success factors as well as aligning these success factors with business strategies. This underpins nowadays close relationship between business strategy, IORs and their realization by means of inter-organizational systems.

In this paper, we present (i) a systematic literature review studying success factors and their impact on IORs as well as (ii) an analysis of the results found. The review is based on 177 publications, published between 2000 and 2012, dealing with factors influencing IORs. The work presented provides an overview on success factors, influencing relationships between success factors, as well as their influence on the success of IORs. The work is somehow "meta-

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empirical" as it only looks at published studies and not on own cases. Consequently, it is based on the assumption that studies in scientific literature represent the real-world.

The constructs and relationships found in the review are grouped based on their scope and summarized in a cause and effect model. The grouping of constructs results in five groups including Relationship Orientation, Relational Norm, Relational Capital, Atmosphere, and Others. Since the cause and effect model represents a directed graph, different network analysis methods may be applied for analyzing the model. In particular, an in- and out-degree analysis is applied on the cause and effect model for detecting the most influencing as well as the most influenced success factors.

Keywords Inter-organizational information systems · Inter-organizational relationships · Inter-organizational success factors · Influencing relationships · Inter-organizational success

1 Introduction and Motivation

Collaboration is an integral aspect of today's businesses since it impacts an organization's performance (Vereecke and Muylle, 2006; Daugherty et al, 2006). Especially in *Business-to-Business (B2B)* scenarios where partnerships are based on inter-organizational business processes and related IT systems, business collaboration are needed to increase profitability, growth, and competitiveness. In such scenarios, *Inter-organizational relationships (IORs)* play a crucial role (Premkumar and Ramamurthy, 1995; Premkumar et al, 2005). The assessment of business collaboration can be conducted based on the evaluation of IORs. In other words, the evaluation of IORs is required for assessing the value of business partners. Furthermore, the evaluation of IORs helps organizations to determine whether the collaboration with business partners should be maintained, or how IORs can be improved (Provan and Sydow, 2008). The evaluation is usually implemented by means of measurements which are based on certain aspects of an IOR. These aspects are typically considered as "*success factors*", such as communication, trust, and information sharing.

Success factors are also required for deriving measurements and for monitoring IORs in the context of performance analysis and strategic management. One of the most widely applied strategic management frameworks, namely the *Balanced Scorecard (BSC)* methodology (Eckerson, 2006) uses success factors as key elements for implementing the scorecard method. The BSC method was originally developed for analyzing an organization's performance across four main perspectives: finance, customer, process, and learning and growth (Kaplan and Norton, 1992). The essence of the BSC method is to align business strategies, or business objectives, with measures usually called *Key Performance Indicators* (KPIs). The application of the BSC methodology allows organizations evaluating business performance against the different perspectives of their business strategies. However, the BSC methodology does not suggest how to identify KPIs for measuring an organization's strategies. This

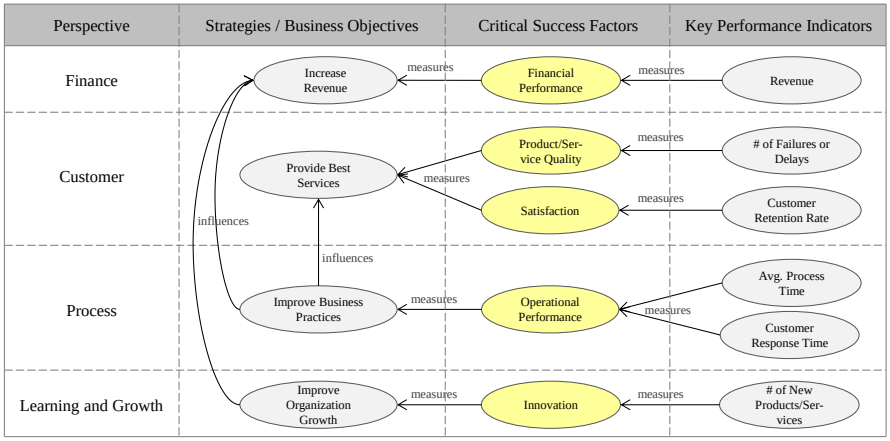


Fig. 1: Balanced scorecard example: linking business strategies to key performance indicators based on critical success factors.

makes the BSC methodology difficult to implement since business strategies are usually too wide and sometimes too ambiguous to identify appropriate KPIs reflecting those strategies.

The BSC methodology best practices suggest to align business strategies with KPIs based on critical success factors (Kaplan and Norton, 2004). In other words, success factors are used for reflecting an organization's strategies. For example, Figure 1 shows a simplified example for applying the BSC methodology utilizing success factors. In the first column of Figure 1, the four different perspectives of the BSC methodology are shown. The subsequent three columns show Business Objectives, Critical Success Factors, as well as KPIs. The KPIs are used for measuring Critical Success Factors, which in turn are used for measuring Business Objectives. Considering KPIs from success factors is easier than considering KPIs from business objectives since success factors focus on particular aspects which are more precise than business objectives.

For example, in Figure 1, the customer perspective is comprised of the business objective "Provide Best Services". This business objective is linked to the success factors "Product/Service Quality" and "Satisfaction". The success factor "Product/Service Quality" focuses on the quality of product and service. Therefore, the KPIs concentrate on measuring product/service quality such as number of failures or delays. Similarly, the KPIs reflecting the success factor "Satisfaction" are derived in a similar manner. The other perspectives are measured similarly by defining proper business objectives, critical success factors, as well as KPIs.

The simplified example shows the complex relationships between business objectives, critical success factors, and KPIs. One core aspect in these complex relationships are critical success factors. Thus, a thorough understanding of success factors, the influencing relationships between them, as well as their

influence on business objects is required. A lack of understanding may lead to difficulties in evaluating an organization's strategies or business objectives.

For understanding the impact of success factors on IORs we (i) conducted a systematic literature review (Brereton et al, 2007) as well as (ii) analyzed the results. The aim of the systematic literature review is to identify success factors related to IORs and to provide an understanding of the influencing relationships between success factors. Based on the assumption that scientific literature reflects reality we conducted the review on publications during the last decade. Several studies identify success factors related to IORs and their effects on each other. In this work, we concentrate on IORs in general rather than on information technology which supports IORs. Nevertheless, we consider information technology as one of the success factors influencing the success of IORs and analyze its effect on IORs together with other success factors.

However, since most of the studies focus on some particular success factors and to understand the whole context of IORs we integrated these success factors and their influencing relationships in an overall cause and effect model. The integration was achieved by grouping the success factors identified according to their definitions and measurements. The grouping resulted in a cause and effect model which describes the success factors having an impact on IORs. The cause and effect model was further simplified by applying inference and redundancy checking rules. Moreover, the cause and effect model represents a directed graph, i.e. a directed network of inter-organizational success factors. Consequently, network analysis methods were applied on the cause and effect model for gaining insights in inter-organizational success factors.

The remainder of the paper is organized as follows: Section 2 provides an overview of the research process applied. A detailed description of the implementation of the review is provided in Section 3. The grouping and simplification of the results leading to the cause and effect model, is described in Section 4 and Section 5. Section 6 describes the application of an in-degree and an out-degree analysis on the cause and effect model as well as provides an interpretation of the results. Finally, we conclude the paper in Section 7.

2 Research Method

In the following, the research process followed in this paper is described. The research process is depicted in Figure 2 and consists of four main activities: (i) conducting a systematic literature review, (ii) grouping and organizing the constructs found, (iii) simplifying their relations in order to derive a minimum set of influencing relationships, and (iv) analyzing the constructs based on an in- and out-degree analysis. To tackle each activity different methodologies are applied.

The first step is to obtain constructs from relevant literature which relate to the success of IORs. We conducted a review for identifying such constructs as well as their influencing relationships (cf. Figure 2, Mark 1). The review was

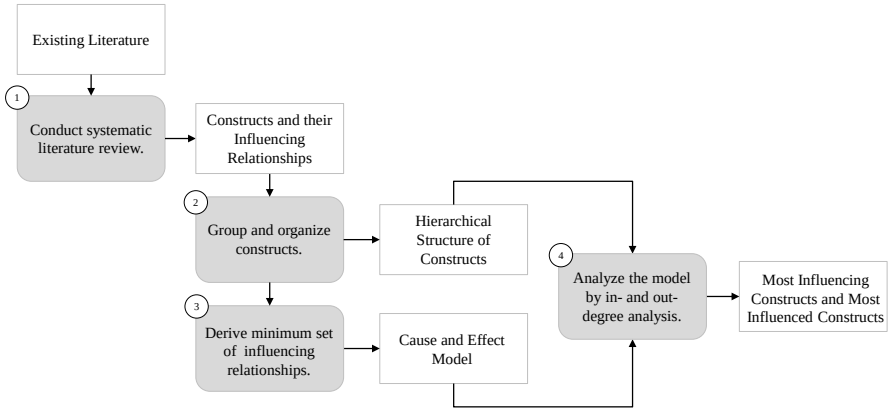


Fig. 2: Overview of research method

conducted by following the methodology of systematic review (Brereton et al, 2007). The literature taken into account had to be published during the last decade as well as had to fulfill certain inclusion criteria. Based on the selected literature we extracted (i) constructs or success factors together with their measurements as described in literature, and (ii) the influencing relationships among them. The process and the results of the systematic literature review are discussed in Section 3.

In consecutive steps the constructs and the influencing relationships between the constructs are further simplified (cf. Figure 2, Mark 2 and 3). The simplification consists of two main tasks: (i) grouping constructs (cf. Figure 2, Mark 2), and (ii) deriving the minimum set of influencing relationships between the constructs (cf. Figure 2, Mark 3).

Grouping constructs is achieved by organizing the constructs in a hierarchical structure by assigning part-of relationships based on their definition and their measurements. This yields to hierarchical relationships between the constructs. The method employed in this task is developed based on and inspired by the studies of context-aware semantic analysis. These studies include the work of Landauer and others which introduced the latent semantic analysis that considers word contexts to determine the similarity of words (Landauer et al, 1998), as well as other similar work on context-aware interpretations such as (Zhang et al, 1995) and (Lin, 1998). In particular, our method of grouping constructs takes both, the definitions of constructs and their measurements as the surrounding contexts, into account. A discussion of the method and the results of grouping constructs is provided in Section 4.

The influencing relationships in the hierarchical structure are further simplified in order to derive a minimum set of influencing relationships. In addressing this task, redundant influencing relationships are removed by applying inference rules and redundancy checking rules. In other words, we refine the influencing relationships by adapting a rule-based method. We developed

logical rules (Leone et al, 2006a) for (i) representing knowledge about influencing relationships among constructs and (ii) inferring hidden influencing relationships by applying a reasoning technique.

The result after the implementation of this step is a minimum set of influencing relationships presented as a cause and effect model. In other words, the result is comprised of the necessary influencing relationships which allows recreating all influencing relationships by applying inference rules. A thorough discussion of this step is found in Section 5.

The resulting cause and effect model is then analyzed for deriving new insights (cf. Figure 2, Mark 3). Since the cause and effect model represents a directed graph, the methodology of network analysis can be employed. In this task we use network centrality measures (Newman, 2010) to derive an implication about the constructs playing an important role in the success of IORs. In particular, we applied an (i) out-degree analysis to identify most influencing constructs and an (ii) in-degree analysis to identify most influenced constructs. The analysis as well as its corresponding results are discussed in Section 6.

3 A Systematic Literature Review on Success Factors

The implementation of the review follows the systematic literature review methodology (Brereton et al, 2007). The review has three main phases: (i) defining the research questions and the review protocol, (ii) conducting the review and (iii) documenting the knowledge. In the following, each of the these phases is discussed in detail.

3.1 Research Questions and Review Protocol

The objective of the review is to identify success factors playing important roles in the success of IORs. Consequently, the *research question* is: *"What are the success factors affecting the success of IORs and how do success factors influence each other?"*.

The studies that are of interest in this review directly and indirectly deal with inter-organizational success factors. Generally speaking, the studies of interest primarily cover the following three areas of interest. First, several studies directly investigate inter-organizational success factors and the relationships among success factors. Second, other studies address inter-organizational performance evaluation which typically includes measurement aspects that reflect the success of an organization. This typically implies that those aspects can be perceived as success factors. Third, studies on business partner selection usually provide selection criteria. These criteria imply that having partners matching these criteria lead to the success of IORs. Thus, the selection criteria can be considered as success factors as well.

For answering the research question we developed a review protocol and search criteria covering the aforementioned topics. The protocol as well as the search criteria are discussed in the following.

Database

The database used for obtaining the literature reviewed was retrieved using Google Scholar. The literature search was limited to literature published between the years 2000 and 2012.

Keywords

The keywords cover three topics including inter-organizational relationships, success factors, and the evaluation of IORs. These topics correspond to the aforementioned areas of interest. For acquiring literature in these topics different search terms have been used which are listed in the following. Furthermore, we included the supply chain context and considered it as a type of IOR since it is widely studied in terms of measurement and evaluation. Summarizing, the following key words have been used: `inter-organizational relationship(s)`, `inter-organizational relationship success factor`, `measure inter-organizational relationship performance`, `supply chain measure`, `performance measure supply chain`, `performance measurement supply chain`, `inter-organizational measures`, and `B2B performance measures`.

Inclusion Criteria

The inclusion criteria specified in the following have to be fulfilled by the literature found in order to be included in the review.

1. The literature must be in English and electronically accessible.
2. The literature must be published as a conference paper, journal paper, PhD thesis, masters thesis, or technical report.
3. The main study should
   (a) focus on success factors (i.e. constructs) influencing the success of IORs or aspects commonly being used for evaluating IORs or business partners.
   (b) focus on the evaluation and measurement for IORs.
   (c) mention or highlight some example of measures related to IORs.

Exclusion Criteria

The criteria listed in the following represent exclusion criteria for the literature found. As mentioned earlier, our study focuses on success factors influencing IORs rather than success factors influencing the use of information technology. Therefore, studies concentrating on the use of information technology are excluded. The exclusion criteria are defined as follows:

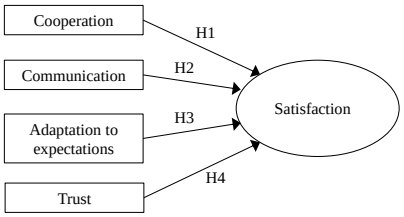
1. The literature is not in English and not electronically accessible.
2. The main study
   (a) focuses on factors influencing the success of inter-organizational systems and applications.
   (b) focuses on the adoption of information technology.

3.2 Conduct the Review

The relevant studies are identified according to the review protocol. We selected relevant literature based on their abstract and conclusion that met the criteria. For each keyword combination we implemented the search up to 20 pages since the candidate literature is mostly found up to page 15-17. If there are still some literature on the 20th page which meet the criteria we continue searching on the next page. We keep searching on the next page until we reach the page that has no literature matching the search criteria. Following this process 177 primary studies have been found [1]. In a consecutive step the main author manually extracted two key information concepts from the selected studies: (i) constructs related to IORs with their measurement items used for evaluating these constructs, and (ii) the influencing relationships between these constructs. Depending on the area of the studies the information extraction approach differs, as described in the following:

- **Success factors in IORs.** In case a success factor is directly mentioned in the study, the success factor and its corresponding measurement are directly extracted as a construct. Moreover, some studies also provide the information on influencing relationships among their focused constructs through an empirical analysis. In the set of our selected publications, we found that there are two methods of empirical analysis applied for proving influencing relationships between constructs. These are (i) hypothesis testing and (ii) case studies or interviews. An example of hypothesis testing is found in the study of Cambra-Fierro and Polo-Redondo (Cambra-Fierro and Polo-Redondo, 2008). In their study, the conceptual model of constructs influencing customer satisfaction is proposed as shown in 3a. Each influencing relationship is analyzed by using hypothesis testing based on the data collected from the survey. The results support all hypotheses. Hence, we extract those influencing relationships. Another example is the case study of a company from the automotive sector conducted for improving the performance of supply chains (Gautier, 2010). One of the results in this case study indicates that trust influences supply chain performance as shown in Figure 3b. In this case, we extract an influencing relationship between trust and supply chain performance.
- **Performance analysis and performance management in IORs.** In this case, we investigate measurement or management aspects mentioned

[1] A list of reviewed studies is provided in our supplement which can be found at the following link: `http://edimine.ec.tuwien.ac.at/supplement.pdf`.



(a) Influencing model in Cambra-Fierro and Polo-Redondo (2008)

…This case study proved in practice the importance of trust in inter-organizational relationships. It also highlighted the impact of some dimensions of trust on the supply chain performance …

(b) Quote from the result in Gautier (2010)

Fig. 3: Excerpt examples of influencing models and results found in the set of selected publication

in the study and extract them as constructs related to the success of IORs. For example, the study of total quality management (TQM) and supply chain management (SCM) of Talib and others is considered. They identified six major TQM practices and six major SCM practices that are frequently applied in different research papers regarding TQM and SCM (Talib et al, 2011). This includes top-management commitment, customer focus, training and education, supplier management, information and communication technologies, etc. From their study, we extract these aspects as a construct related to IORs. Moreover, if measurement items (KPIs, scale items, interview questions for measuring those aspects) are provided in the studies, we extract the measurement items for the corresponding aspects as well.

– **Business partner selection.** Studies on business partner selection usually describe criteria for selecting business partners that can influence the success of business relationships. By considering those criteria, we identify the aspects/perspectives of the criteria and extract them as a construct. Furthermore, some of these studies also provide the empirical results to prove the impact of their proposed criteria on the success of IORs. In this case, we also extract influencing relationships among these criteria and the success of IORs. For instance, the study of partner selection and the influences on the business performance of Moeller (Möller, 2010) not only provides the criteria for selecting business partners, but also provides the empirical analysis on the effect of partner selection on business performance. In detail, the hypothesis of the effect of partner selection on business performance is identified and tested. Examples of such hypotheses are whether partner selection has an effect on trust, whether trust has an effect on commitment, or whether commitment has an effect on performance. If a hypothesis is supported by the analysis result, we extract this information as an influencing relationship between constructs. For example, in the study of Moeller (Möller, 2010) the analysis result supports the hypothesis that trust has an effect on commitment. Therefore, we identify an influencing relationship between trust and commitment.

Type of literature	Area of study			Total (by type)
	Success factors in IORs	Performance analysis in IORs	Business partner selection	
Journal	73	80	8	161
Conference	8	4	2	14
Workshop	0	1	0	1
Thesis	1	0	0	1
Total (by area)	82	85	10	177

Table 1: Summary of selected literature by area of study

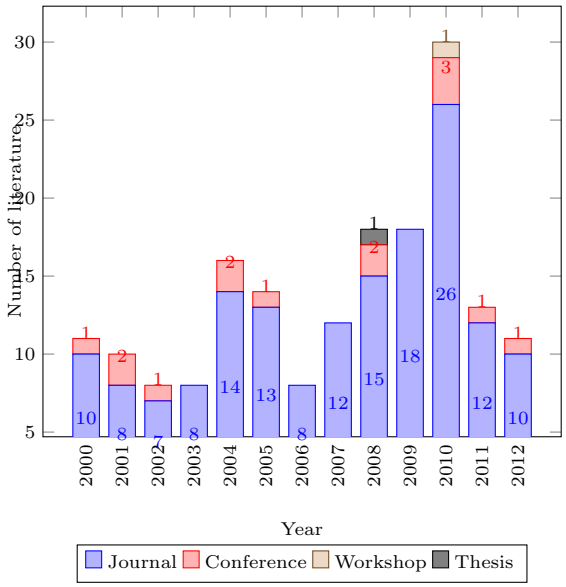


Fig. 4: Histrogram showing number of papers by year

3.3 Document the Knowledge

Four different types of literature are present in the set of the selected studies. These include (i) journal publications, (ii) conference publications, (iii) workshop publications, and (iv) theses. Table 1 summarizes the area of study and number of literature focusing on each area.

As illustrated in Table 1 the majority of selected literature is of type journal (161 out of 177). The remaining studies are of type conferences (14 out of 177), workshops (1 out of 177), and theses (1 out of 177). The majority of literature in this set focuses on the studies of success factors and performance analysis in IORs. In particular, 82 out of 177 papers study success factors in IORs, and 85 out of 177 papers study performance analysis in IORs. The remaining literature focuses on the study of business partner selection, i.e. 10 out of 177 papers.

Figure 4 shows number of papers by year. As mentioned, the selected literature had to be published during the years 2000-2012. Around 80% of the

studies are published during 2004-2012. Therefore, the selected studies can be considered up to date and still valid.

Based on the set of studies investigated, 88 constructs and 261 influencing relationships between these constructs have been found[2]. The constructs and influencing relationships are further simplified by performing a grouping based on their definitions and measurements. This results in a simplified cause and effect model describing influencing relationships between constructs. The simplification reduced the number of constructs to 56 constructs. The cause and effect model is further simplified by applying inference and redundancy checking rules. By applying these rules the total number of influencing relationships is reduced to 126 relationships. The model is later used for conducting an in- and out-degree analysis for deriving implications about the most influencing as well as the most influenced constructs. The discussion on the simplification and the in- and out-degree analysis is provided in the following sections.

4 Grouping of Inter-organizational Success Factors

As mentioned before, more than 80 constructs have been found in the studies. For simplifying this information the constructs are grouped according to two different methods. The methods for grouping constructs include (i) grouping based on the definition of constructs as well as (ii) grouping based on the measurement of constructs. The grouping based on these methods leads to either similar constructs or multi-dimensional constructs. Each of these scenarios is discussed in more detail in the following. Names of constructs as well as their definition and measurements are originally from literature. Any terms and definitions used below stem from literature and are cited accordingly.

Similar Constructs. We found that certain constructs can be considered the same according to their definition and the way the constructs are measured. Thus, constructs sharing a similar definition as well as a similar way of measurement are considered as the same construct.

For example, the construct *Collaboration*, *Cooperation*, and *Integration* have similar definitions which relate to co-working among business partners. In this case, we summarize these constructs with a construct called *Cooperation and Integration*.

Multi-dimensional Constructs. Multi-dimensional constructs rely on assigning "*part-of*" relationships between the construct having other constructs as its dimensions. Some constructs explicitly indicate that they consist of several dimensions while some are found to have overlapping definitions or measures which can be implicitly considered as their dimensions.

For instance, the definition of the construct *Connectedness* is described in (Cheng, 2011) as "*Connectedness indicates the dependence on each other for assistance, information, commitments or in respect of other behaviors that encourage coordination among individuals, departments or organizations*". Thus,

[2] A list of extracted influencing relationships is provided in the following supplement: `http://edimine.ec.tuwien.ac.at/supplement.pdf`.

we conclude that *Connectedness* is a part of *Dependency* since according to its definition it is a kind of dependency in terms of behaviors or relationships (cf. Fig. 9, Connectedness construct).

Another example is given from the context of *Communication*, *Information Sharing*, and *Information Quality*. The different measurements for measuring these constructs are depicted in Table 2. As shown in Table 2, the measurement of *Communication* covers the measurement of *Information Sharing* and *Information Quality*. In particular, *Information Sharing* tends to measure if organizations and their business partners keep informing each other about changes or any information that affect their business, whereas *Information Quality* tends to measure if the exchanged information is timely, accurate, complete, adequate, and reliable. The measurements of, both, *Information Sharing* and *Information Quality*, are also found in the measurement of *Communication* (cf. Table 2). Therefore, we categorize *Information Sharing* and *Information Quality* as dimensions of *Communication* by assigning part-of relationships between them (cf. Fig. 9, Communication construct).

Moreover, the part-of relationship is a transitive relationship. This means that whenever a construct A is a part of B and B is a part of C, then A is also a part of C. For example, *Information Sharing* is a part of *Communication* and *Communication* is a part of *Relational Norm* then we perceive that *Information Sharing* is also a part of *Relational Norm*.

Interpretation of the Hierarchical Structure. After the simplification of constructs, 56 constructs are defined and organized as a hierarchical structure as depicted in Figure 9. The arrow describes part-of relationships denoted as "partOf". The construct, that is on the arrowhead side, is a construct which consists of the construct on the other end of the arrow. For example, the arrow from *Information Sharing* to *Communication* represents that the construct *Information Sharing* is a part of the construct *Communication*. In other words, *Communication* consists of *Information Sharing*. As shown in Figure 9, there are four main groups of constructs: *Relationship Orientation*, *Relational Capital*, *Relational Norm*, and *Atmosphere*. Constructs which do not fit any of the four groups mentioned are grouped into the fifth group, named *Others*. Each of these groups is discussed in the following.

Removal of Redundant Influencing Relationships. Grouping constructs also implies removing redundant influencing relationships. For example, *Flexibility* is grouped with *Adaptability*. Since there is an influencing relationship between *Adaptability* to an additional construct, as well as between *Flexibility* to the same construct in relation with *Adaptability*, we consider one of them as a redundant relationship since *Adaptability* and *Flexibility* are considered as the same construct. Consequently, we remove one redundant influencing relationship. Through performing this grouping and simplification, the hierarchy is simplified to 56 constructs 212 influencing relationships (cf. Fig 9).

In the following, we discuss the different groups of inter-organizational success factors resulting from the grouping conducted. In summary, 88 constructs and 261 influencing relationships have been identified. By simplifying the hier-

Communication (Chen and Paulraj, 2004)	Information Sharing (Li et al, 2006)	Information Quality (Li and Lin, 2006)
1. We share sensitive information (financial, production, design, research, and/or competition). 2. Suppliers are provided with any information that might help them. 3. Exchange of Information takes place frequently, informally and/or in a timely manner. 4. We keep each other informed about events or changes that may affect the other party. 5. We have frequent face-to-face planning/communication. 6. We exchange performance feedback.	1. We inform trading partners in advance of changing needs. 2. Our trading partners share proprietary information with us. 3. Our trading partners keep us fully informed about issues that affect our business. 4. Our trading partners share business knowledge of core business processes with us. 5. We and our trading partners exchange information that helps establishment of business planning. 6. We and our trading partners keep each other informed about events or changes that may affect the other partners.	1. The information exchange between our partners and us is: – timely – accurate – complete – adequate – reliable

Table 2: Example measurement items of *Communication*, *Information Sharing*, and *Information Quality*. The measurement items of *Communication* cover the measurement items of *Information Sharing* in terms of the frequency of communication and the communication about changes or events. The measurement items of *Communication* cover the measurement items of *Information Quality* in terms of information timeliness, accuracy, completeness, adequateness, and reliability.

archical structure through the grouping of constructs based on their definitions and measurements, the total number of constructs and influencing relationships has been reduced to 56 constructs and 212 influencing relationships.

4.1 Relationship Orientation

The *Relationship Orientation* represents the tendency of an organization to maintain relationships with partners (Cheng and Sheu, 2012). It is found to be a factor fostering IORs in various dimensions, such as performance and relationship quality.

In long-term relationships business partners tend to have more willingness to share risks and benefits (Ziggers and Henseler, 2009; Cooper and Ellram, 1993; Chen et al, 2004). A long-term relationship orientation may lead to greater commitment and trust (Chen et al, 2004) as well as may promote collaborative communication. This in turn supports greater cooperation, strengthens relational bond (Paulraj et al, 2008; de Toni and Nassimbeni, 1999; Kotabe et al, 2002; Mohr et al, 1996; Powell et al, 1996), reduces functional

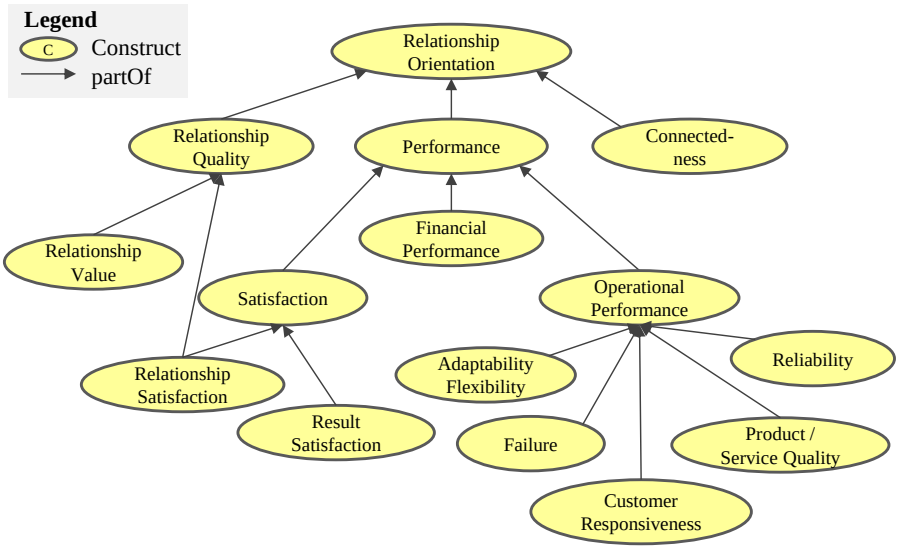


Fig. 5: Relationship orientation group

conflict (Morgan and Hunt, 1994), improves a firm's performance (Carr and Pearson, 2002), and has a lasting effect on competitiveness of the entire supply chain network (Kotabe et al, 2002). The measurement of relationship orientation, such as in (Prajogo and Chowdhury, 2010) and (Fantazy et al, 2010), typically measures the attitude of business players towards their relationships in the long run.

Furthermore, *Relationship Orientation* could be determined based on *Performance* (i.e., relationship benefit), *Relationship Value*, and *Connectedness* among partners (Cheng and Sheu, 2012). Therefore, these constructs are classified as dimensions of relational orientation, as shown in Figure 5.

Performance includes the concept of relationship benefits since the measures of relationship benefits are similar to the measures of performance. In particular, the measurements for relationship benefits include financial measures such as profitability and cost, non-financial performance measurements such as delivery time, lead time, product quality and satisfaction (Jonsson and Zineldin, 2003; Cambra-Fierro and Polo-Redondo, 2008; Cheng, 2011; Cheng and Sheu, 2012). These measurements are similar to performance measurement in general.

In this paper, we divide *Performance* into three different dimensions: (i) *Financial Performance*, (ii) *Operational Performance* and (iii) *Satisfaction* since we found that in literature these three dimensions are commonly used to measure performance. Although, it is not always the case that all of them are considered together, performance measurement is still centered around these three perspectives. For example, some of them include satisfaction in per-

formance measurement (Moon, 2011; Liu et al, 2009; Seppänen, 2008), some of them refer only to financial and operational performance (Whipple et al, 2010; Wiengarten et al, 2010; Johnston et al, 2004; Kohtamäki et al, 2012; Liu et al, 2012; Paulraj et al, 2008; Hernández-Espallardo et al, 2010; Aramyan et al, 2007; Prajogo and Chowdhury, 2010; Chen et al, 2004; Yeung, 2008; Shin et al, 2000; Corsten et al, 2011; Green Jr et al, 2008; Flynn et al, 2010; Li et al, 2006; Krause et al, 2007; Ryu et al, 2009; Chen and Paulraj, 2004; Otto and Kotzab, 2003; Ziggers and Henseler, 2009; Soni and Kodali, 2010; Chan, 2003), while some of them focus only on either the financial (Corsten et al, 2011; Hsu et al, 2008; Möller, 2010; Fantazy et al, 2010; Hu et al, 2010) or on the operational perspective (Ambrose et al, 2010; Zhou and Benton Jr, 2007). *Financial Performance* typically focuses on outcomes related to economics such as profitability, cost and return on assets, whereas operational performance reflects how well organizations perform in their operations.

There are several dimensions used for evaluating the construct *Operational Performance*, such as, quality (Prajogo and Chowdhury, 2010), efficiency (Aramyan et al, 2007), effectiveness (Ashnai et al, 2009), adaptation/flexibility (Prajogo and Chowdhury, 2010; Aramyan et al, 2007; Ashnai et al, 2009), responsiveness (Aramyan et al, 2007; Huan et al, 2004; Chen et al, 2004), productivity (Zhao, 2002), delivery (Prajogo and Chowdhury, 2010), reliability (Huan et al, 2004), and failure (Corsten et al, 2011). For this reason the constructs, found in the review and which are similar to the dimensions mentioned, are considered as a part of operational performance. Therefore, *Adaptability/Flexibility*, *Product/Service Quality*, *Customer Responsiveness*, *Reliability*, and *Failure* are considered as a part of *Operational Performance*.

Adaptability and Flexibility are similar in meaning. Singh and others (Singh et al, 2011) state that flexibility is the ability to deal with uncertainty, modification, or any variety of customer needs which is similar to the definition of adaptability in (Jonsson and Zineldin, 2003; Ashnai et al, 2009) and (Woo and Ennew, 2004).

However, when considering measurement scales mentioned in literature, they are slightly different. In (Jonsson and Zineldin, 2003; Woo and Ennew, 2004; Ambrose et al, 2010) and (Cambra-Fierro and Polo-Redondo, 2008), the measurement of adaptation emphasizes more on the ability to adapt the operation or behavior to meet customer needs, while the measurement of flexibility tends to focus more on dealing with unexpected changes and unexpected situations (Johnston et al, 2004). Nevertheless, they are considered as the same construct in general since both of them focus on the ability of an organization to adapt itself to changes. In addition, *Product/Service Quality* aims to evaluate the products and services provided by partners. *Customer Responsiveness* focuses on how fast the organization responds to its partners' requests. *Reliability* mostly focuses on delivery performance such as whether the delivery is on time, or how often the delivery is delayed, etc. *Failure* covers any failure in operational processes.

The last dimension of performance is, as mentioned earlier, *Satisfaction*. In general, satisfaction is intangible. It is an emotional response to the difference

between what customers expect and what they actually receive (Jonsson and Zineldin, 2003). Whipple et al suggest that there are two dimensions of satisfaction: *Result Satisfaction* and *Relationship Satisfaction*. Satisfaction with result focuses on performance issues, whereas satisfaction with relationship focuses on relationship activities, such as decision-making participation, information sharing, and coordination (Whipple et al, 2010).

Relationship Quality is the strength of a relationship as well as the extent to which a relationship meets the need or expectation of partners based on the history of successful or unsuccessful events (Ashnai et al, 2009). By considering its measurement scales we found that relationship quality consists of *Relationship Satisfaction* and *Relationship Value*. *Relationship Satisfaction* is also considered as a part of *Relationship Quality* because it appears as one of the measurement scales of relationship quality in (Cambra-Fierro and Polo-Redondo, 2008). Moreover, some of the measurement scales of *Relationship Quality* are matched with the measures of relationship value (Cheung et al, 2010; Gil-Saura et al, 2009) and relational proclivity (Cheng, 2011; Cheng and Sheu, 2012) which try to measure if the relationship supports or motivates the positive outcomes. Therefore, we group the terms relationship value and relationship proclivity as a construct called *Relationship Value* and define it as a part of *Relationship Quality*.

Connectedness is also mentioned to be one dimension of relationship orientation. It indicates the dependence of partners on each other for assistance, information exchange, and commitments or in respect of other behaviors which encourage coordination of departments or organizations (Cheng, 2011). To the best of our knowledge, connectedness is a dependence in terms of behavior which is similar to closeness and bond. They refer to the degree of how much the partners are close to or depend on each other in terms of decision making.

4.2 Relational Capital

Relational Capital or social capital are described in literature as relationships having dimensions such as trust, shared goals, open interaction, feelings of shared destiny, and togetherness (Kohtamäki et al, 2012). Thus, we perceive that *Relational Capital* consists of *Trust*, *Shared Vision*, and *Connectedness*. Figure 6 shows the structure of the *Relational Capital* group. The definition of *Connectedness* is the same as introduced earlier.

Trust is one of the most widely studied constructs which is shown to have a lot of effects on other constructs. Trust on the inter-organizational level typically refers to many different terms such as credibility, openness, benevolence, integrity, predictability, competence, reliability, etc. (Seppänen et al, 2007; Zaheer and Harris, 2006; Saunders et al, 2004).

In this paper, we consider *Trust* in two main dimensions, namely *Credibility* (Whipple et al, 2010; Ambrose et al, 2010; Moon, 2011) and *Benevolence* (Whipple et al, 2010; Ambrose et al, 2010; Johnston et al, 2004; Ryssel

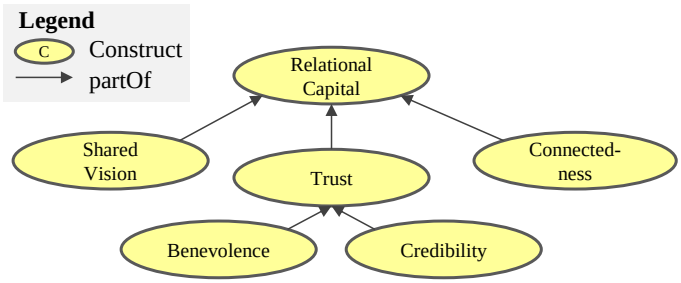


Fig. 6: Relational capital group.

et al, 2000). The reason is, that these two dimensions are commonly mentioned in the literature.

Credibility reflects the belief of an organization towards its partners that they perform tasks as expected. From the measurements in (Ambrose et al, 2010) and (Moon, 2011), credibility focuses on honesty and integrity, reliability, commitment and fulfillment, keeping promises, and the fulfillment of duties. We conclude that credibility tends to focus on the operational perspective in the sense of how well partners perform tasks. We also group reputation with credibility since gaining reputation means gaining credit.

Benevolence reflects the motivation, willingness, and care that business partners tend to have for an organization. It can be seen as a construct against opportunism (Saunders et al, 2004). Benevolence tries to measure the willingness to work or help business partners. For example, the measurement scales are: Does the supplier/partner care for us? Do we see our partner as a friend and vice versa? Can we count on our partner in major issues or problems? (Ambrose et al, 2010; Johnston et al, 2004; Ryssel et al, 2000). This also covers the concept of support (Hald et al, 2009) which refers to the perception that partners will help with their own free will without having any apparent or immediate benefits to themselves.

Shared Vision is defined in (Li and Lin, 2006) as the degree of similarity of shared values and beliefs between partners. It is a kind of compatibility in terms of business objectives and strategies at the strategic level. Generally, this covers the terms shared destination, shared values (Hald et al, 2009), shared goal, strategy fit (Ryu et al, 2009), goal compatibility, and goal consistency (Kim et al, 2010). The measures of shared vision are designed to evaluate if business partners have a similar understanding about the business objectives of each other.

4.3 Relational Norm

In literature the concept of *Relational Norm* is defined ambiguously. Although Liu et al (Liu et al, 2009) define it as the expected norms shared by a group

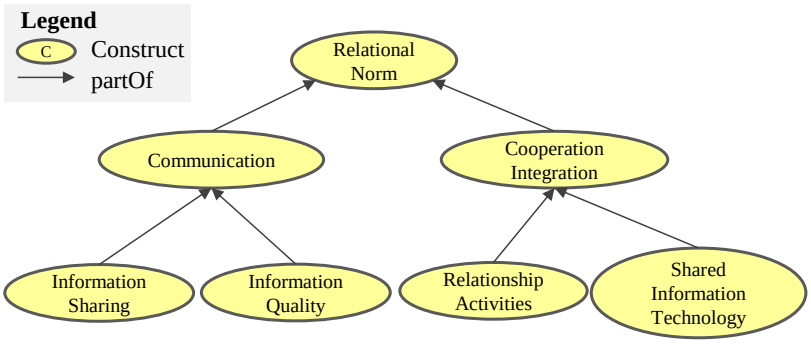


Fig. 7: Relational norm group.

of decision-makers and directed towards collective goals, it is still not clear to what exactly the norm refers to. According to the studies in relational norms, Doucette defines relational norm as solidarity, information exchange and role integrity (Doucette, 1996). Similarly, relational norm is defined as solidarity, information exchange and flexibility in (Heide and John, 1992).

From both definitions, solidarity and information exchange are in common. Solidarity refers to the expectation of partners that they appreciate the relationship and will work to preserve it (Doucette, 1996) by establishing activities that help maintaining the relationship such as joint problem solving, meeting obligations, etc. In (Heide and John, 1992), the solidarity measurement scales consist of items expressing the expected efforts of all partners towards preserving the relationship such as joint responsibility. Thus, solidarity can be considered as behavior of business partners that work together or collaborate to achieve their shared goals and to maintain their relationship. Therefore, we consider solidarity the same as collaboration and cooperation.

Information exchange refers to bilateral expectations that partners provide useful information to each other (Doucette, 1996). The measurement scales of information exchange focus on the frequency as well as the proprietary or importance of the information itself (Heide and John, 1992). This in turn could be seen as a whole concept of communication which is similar to the relational norm perceived in (Liu et al, 2009). The reason is that the measurement scales of relational norm in (Liu et al, 2009) focus on communication, information sharing and joint working (e.g. joint problem solving, joint consultations, and discussions). Therefore, we divide *Relation Norm* into *Communication* and *Cooperation and Integration*, as illustrated in Figure 7.

Communication is divided into *Information Sharing* and *Information Quality* since we found that their measurement scales mostly cover the measurement scales of information sharing and information quality. For example, the measure scales for communication described in (Jonsson and Zineldin, 2003; Cambra-Fierro and Polo-Redondo, 2008; Zhao, 2002; Ryu et al, 2009; Paulraj et al, 2008; Chen et al, 2004; Fantazy et al, 2010) are similar to the

measurement scales for information sharing described in (Li and Lin, 2006; Cheng, 2011; Corsten et al, 2011; Li et al, 2006). The measurement scales for information sharing focus on frequency, informality, usefulness of information exchange, and proper communication. Furthermore, the measurement of communication in (Paulraj et al, 2008; Chen et al, 2004; Fantazy et al, 2010) and (Chen and Paulraj, 2004) also covers information quality which focuses timeliness and accuracy. Some studies even use the same measurement scales interchangeably between communication and information quality, such as (Ambrose et al, 2010) for communication and (Li and Lin, 2006; Li et al, 2006; Wiengarten et al, 2010) for information quality.

Cooperation and Integration is another dimension of relational norm. It is one of the most widely studied constructs that is found to relate to the success of IORs. This concept includes the terms cooperation (Woo and Ennew, 2004; Cambra-Fierro and Polo-Redondo, 2008), collaboration (Woo and Ennew, 2004; Ryu et al, 2009), coordination (Ashnai et al, 2009), integration (Prajogo and Chowdhury, 2010; Flynn et al, 2010) and supply chain linkage (Lee et al, 2007). Cooperation, collaboration and coordination clearly refer to the degree of joint working between partners in general whereas integration and supply chain linkage emphasize on the collaboration on the operational level. The collaboration in the operational level includes, for instance, the integration of business processes and activities. In this paper, we define the collaboration covering both, the operational and the strategic level.

Relationship Activities and *Shared Information Technology (Shared IT)* are classified as a part of collaboration. Shared IT reflects collaboration in terms of platforms, systems, or infrastructure integration. Relationship activities refer to any activities that are jointly conducted or implemented together with partners. These include the concepts of direct involvement (Krause et al, 2007), joint responsibility (Johnston et al, 2004), shared planning (Johnston et al, 2004), partner engagement in CRM (Duffy et al, 2012), and social mechanisms (Cousins et al, 2008).

4.4 Atmosphere

Atmosphere is studied in (Woo and Ennew, 2004) and described in terms of a relationship that is dependent on power, conflict, cooperation, closeness or distance of the relationship, and mutual expectations between business partners. From the definition, we define *Cooperation and Integration* explained in the last sub-section, *Power* and *Conflict* as dimensions of *Atmosphere*. Figure 8 depicts a hierarchical structure of constructs in the *Atmosphere* group.

Power is the ability to (i) influence behavior and decisions and to (ii) cause others to do something they would not have done otherwise (Jonsson and Zineldin, 2003; Ashnai et al, 2009; Cheng, 2011). It can be perceived in positive and negative senses. Positive power includes mutual or symmetry power which refers to the balance of power, and non-coercive power which refers to the power that comes without forcing but instead it comes from reward, expertise,

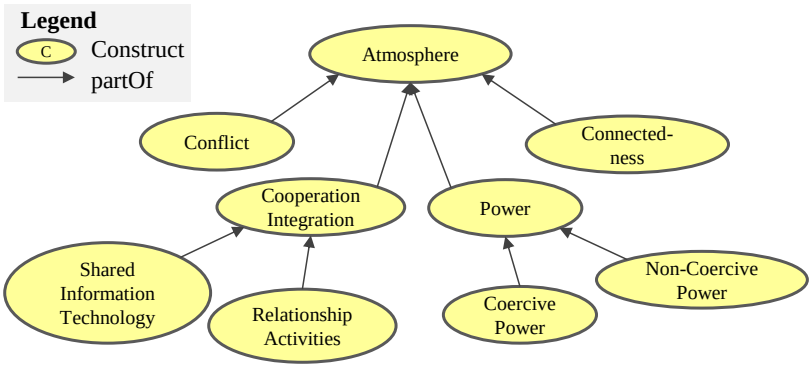


Fig. 8: Atmosphere group.

and legitimacy (Ratnasingam, 2000). The measurement of power symmetry tends to measure if organizations have the ability to influence each other on any decisions or activities (Cheng, 2011). Non-coercive power measurements tend to measure if the organization admires their partners or if they are proud to be affiliated with them which in turn makes the organization willing to adapt to partners' requirements (Jonsson and Zineldin, 2003; Ambrose et al, 2010). In contrast, negative power includes coercive power having its roots from the forcing by punishment mechanism. The measurement scales for coercive power described in (Jonsson and Zineldin, 2003) and (Maloni and Benton Jr, 2000) are likely to help observing if an organization is going to be punished or treated worse when it does not accept the proposals or agreements made. From this reason we divide *Power* into *Non-Coercive Power*, including the concept of mutual power, and *Coercive Power*.

Conflict or dysfunctional conflict in inter-organizational scenarios or supply chain context typically refers to disagreements that occur in the cooperation relationships or the incompatibility of activities, shared resources, and goals between partners (Cheng, 2011). It includes unhealthy behaviors, such as distorting information to harm other decision makers, interacting with each other with hostility and distrust, or forming barriers during the process of decision-making. The measurement of conflict includes interference in decision making, overstating or distorting information to influence partners, and the frequency of disagreements.

4.5 Others

Furthermore, there are other constructs that do not have any major similarities and which can thus not be grouped. Each of these constructs is described in the following.

Dependency is divided into *Connectedness* and *Operational Dependency*. Connectedness is explained earlier as one kind of dependency in terms of behavior. In contrast, operational dependency refers to the dependency at the operational level. It indicates the extent to which the organization depends upon its partners in terms of resources, tools, manufacturers, products, etc. (Jonsson and Zineldin, 2003).

Compatibility is defined as the congruence in organizational cultures and capabilities, business objectives, and visions between partners (Cheung et al, 2010). We divide *Compatibility* into *Shared Vision* as mentioned before, and *Operational Compatibility*. Shared vision implies the compatibility between organizations at the strategic level, while operational compatibility refers to the similarity between organizations' operations, processes, and the way how they conduct business. The measurement of compatibility therefore reflects both, the similarity of an organizations' operations (Ryu et al, 2009; Cheung et al, 2010) and the similarity of business goals (Li and Lin, 2006; Cheung et al, 2010; Kim et al, 2010).

Uncertainty, or environmental uncertainty, reflects organization's volatility and unpredictability (Cheung et al, 2010). In (Li and Lin, 2006), *Uncertainty* is classified into *Customer Uncertainty*, *Supplier Uncertainty*, and *Technology Uncertainty*. Generally, uncertainty is measured around those three dimensions (Ryu et al, 2009; Li and Lin, 2006; Cheung et al, 2010; Moon, 2011). Customer uncertainty can be measured from unpredictable behavior of customers such as the change of orders and product requirements. Supplier Uncertainty reflects unpredictable behavior of suppliers to their customers which includes unpredictability of product quality, delivery time, operations, or the properties of materials within the same batch (Li and Lin, 2006; Chen and Paulraj, 2004). Moreover, technology uncertainty tends to focus on technology changes (Li and Lin, 2006; Chen and Paulraj, 2004; Kim et al, 2010).

Commitment is defined as the willingness of partners to exert effort on behalf of the relationship (Li and Lin, 2006; Whipple et al, 2010) and the believe that an ongoing relationship is important to be maintained (Mysen et al, 2011). There are various items used for measuring commitment. Those measurement items focus on the willingness or the intention to maintain relationships and to devote time and resources such as described in (Jonsson and Zineldin, 2003; Ambrose et al, 2010; Zhao, 2002; Ryu et al, 2009; Li and Lin, 2006; Whipple et al, 2010; Mysen et al, 2011; Liu et al, 2012; Möller, 2010; Maloni and Benton Jr, 2000; Gil-Saura et al, 2009; Ryssel et al, 2000) and (Vijayasarathy, 2010). Moreover, we define *Loyalty* as a behavioral intention as part of *Commitment* since its measures are part of Commitment in terms of the continuation of business or the purchase of products from an organization (Gil-Saura et al, 2009).

Innovation helps organizations survive in the long run since the competition through product and technology innovation is stronger than competition among organizations offering similar products (Corsten and Felde, 2005). The effect of innovation is not only relevant within individual organizations but also covers the inter-organizational context such as supply chains as discussed

in (Corsten and Felde, 2005; Chan, 2003) and (Corsten et al, 2011). If an organization succeeds in innovation, there is a possibility that it can maintain its position in the market among its competitors as well as that it gains additional market share. Innovation is difficult to be measured since it is not clear to which extent the innovation is successful. However, some studies use the number of new products, the percentage of sales of a new product, the percentage decrease in time or resources when new technology or new inventions are applied.

Top Management Support describes the support from top-level managers having an understanding and seeing the importance of a partner's relationship, especially in the supply chain context (Li and Lin, 2006; Chen and Paulraj, 2004). The role of top managers is important for driving the implementation towards successful strategies since they have a better understanding of the needs of an organization's strategies (Chen and Paulraj, 2004).

Relationship Learning is considered as a process to improve behavior or joint activities in a relationship by collaboratively creating more value than by doing it individually (Cheung et al, 2010). The measurement of learning tends to evaluate if there is knowledge created during the collaboration and if knowledge is communicated and applied to create value (Cheung et al, 2010; Gil-Saura et al, 2009).

Equity and Fairness is a perception of an organization that its partners act in fair ways (Hald et al, 2009). The concepts of equity and fairness are similar to the concept of reciprocity of a relationship, as introduced in (Kim et al, 2010). Reciprocity refers to the degree of fairness that the partners perceive about sharing risks, burdens, and benefits (Kim et al, 2010). Interorganizational justice (Duffy et al, 2012; Liu et al, 2012) is also categorized as fairness since it refers to the perceptions of fairness of business partners. In (Duffy et al, 2012) and (Liu et al, 2012), they defined four different types of justice which include distributive justice, procedural justice, interpersonal justice, and information justice.

Distributive justice reflects the perceptions of the weaker partners about the fairness of the division of benefits compared to more powerful partners. Procedural justice refers to the perceptions about the fairness of the formal procedures governing a decision process. Interpersonal justice reflects the fairness at the individual level such as if an individual is treated with politeness, dignity, and respect by other individuals. Lastly, information justice focuses on the adequacy of information provided by partners. Besides, reward and cost introduced in (Whipple et al, 2010) are also included in fairness since they focus on sharing benefits between organizations. The measurement of reward and cost tends to measure if benefits are shared equally and if the partners are willing to share unexpected costs. This is similar to the measurement scales of fairness used in (Kim et al, 2010).

Internal Information Technology (Internal IT) such as information management systems and decision support system have an important role in supporting collaboration between organizations (Ryssel et al, 2000; Ke and Wei, 2005). In this paper, we distinguish information technology (IT) between

internal IT and shared IT. Internal IT covers any information systems or any technologies supporting internal business processes and activities. In other words, *Internal IT* is used only by one organization, while *Shared IT* refers to any information systems or technologies that span beyond organizational boundaries (Ryssel et al, 2000). Such shared IT systems include communication platforms and information systems that provide a control or monitoring platform to other partners.

Strategy Quality is intangible and ambiguous. However, its measurement scales used in (Cheng and Sheu, 2012) tend to focus on the formation, implementation, and comprehensiveness of strategies. A high degree of strategic quality within supply chains could enhance the competitive advantage of the entire supply chain (Cheng and Sheu, 2012).

Contract defines the rights and obligations of partners through formal rules, terms, and procedures by explicitly stating how various future situations will be handled (Liu et al, 2009). Contract is considered as one mechanism for creating structural systems which all partners must comply with. The measurement of contract is quite straight forward by examining if all agreements and obligations are formally defined.

Supply Chain Practice (Li et al, 2006; Zhou and Benton Jr, 2007) refers to any activities that promote effective management of supply chains, such as strategic purchasing (Chen et al, 2004; Fantazy et al, 2010), supply management orientation (Shin et al, 2000), and supply chain management strategies (Green Jr et al, 2008). The *Relationship Activities* are also considered as a part of the *Supply Chain Practice* since all collaboration activities between the supply chain partners could result in an improvement of the supply chain management.

Investment, dedicated investment (Whipple et al, 2010), specific investment (Liu et al, 2009; Corsten et al, 2011; Mysen et al, 2011; Kohtamäki et al, 2012), or relationship investment (Liu et al, 2012) refers to the investment in various ways such as resources and activities made by organizations and dedicated to the relationships with business partners. Investments can be tangible (e.g. manufacturing tools and resources) and intangible (e.g. knowledge, ideas, technology or capability) (Cheung et al, 2010). Investment has been recognized to have a positive effect on an organization's performance. However, the more specialized investment is, the lower its value is in general use (Corsten et al, 2011).

The studies of investment (Liu et al, 2009; Corsten et al, 2011; Cheung et al, 2010; Whipple et al, 2010; Mysen et al, 2011; Liu et al, 2012; Kohtamäki et al, 2012) observed in the review describe measures for investment. These describe simple measurement scales that ask if organizations and its partners have made some significant investments in resources, knowledge, and technology.

Complementarity refers to the lack of similarity or the overlap between core businesses or capabilities, and the extent to which the unique strengths and resources of partners are exchanged. Several studies describe that it positively correlates with Relationship Learning (Cheung et al, 2010). More complementarity means that among different business partners there are also dif-

ferent knowledge bases. Therefore, it is more likely that when there is a diversity and non-redundancy in knowledge then organizations and its partners will have learning opportunities.

Environment Dissimilarity covers the diversity of the market environment, sourcing and distribution choices (Cheung et al, 2010). Thus, it offers flexibility to organizations as well as affects Relationship Learning. Due to the environmental dissimilarity, organizations and its partners are confronted with greater risks and challenges which in turn lead to learning. Environmental dissimilarity can be identified with several items such as government intervention, volatility of regulations, currency exchange rate, overall economic situation, etc. (Cheung et al, 2010).

Competitive Advantage is the extent to which an organization is able to create a defensible position over its competitors (Li et al, 2006). It comprises capabilities that allow an organization to differentiate itself from its competitors. Important competitive capabilities include price/cost, quality, delivery, and flexibility, as described in (Li et al, 2006).

Opportunism is the self-seeking behavior with guile (e.g. deceitfulness, a lack of candor or honesty) including hidden information or hidden action (Mysen et al, 2011). Opportunism includes a wide variety of potentially different behaviors. In an inter-organizational context the behavior is considered to be opportunistic if the behaviors are inconsistent with some prior contract or agreement. In literature on business partner selection, also opportunism is mentioned as a criteria of assessing partners (Möller, 2010). The measurement scales used to justify opportunism tends to find out if partners perform or act in a opportunistic way to achieve their goals (e.g. alter/detour information, lie, breach agreements).

Success can be interpreted in several ways including the achievement of business goals and the improvement of dedicated aspects. Therefore, we group the concepts of success and improvement which also includes the improvement of Supply Chain Management (SCM) success (Li and Lin, 2006).

4.6 Summary of the Grouping

Grouping the constructs and the influencing relationships results in a hierarchical structure of inter-organizational success factors. The grouping of constructs as achieved based on the definitions and measurements of the constructs and their influencing relationships. The results of this step of simplification are presented in Table 3. It is shown that the total number of constructs identified in the review has been reduced from 88 constructs to 56 constructs. Similarly, the total number of influencing relationships has been reduced from 261 influencing relationships to 212 influencing relationships[3].

[3] A list of refined influencing relationships can also be found in our provided supplement: `http://edimine.ec.tuwien.ac.at/supplement.pdf`.

	Constructs	Influencing Relationships
Literature Review	88	261
Grouping Constructs and Relationships	56	212

Table 3: Results after grouping constructs and influencing relationships

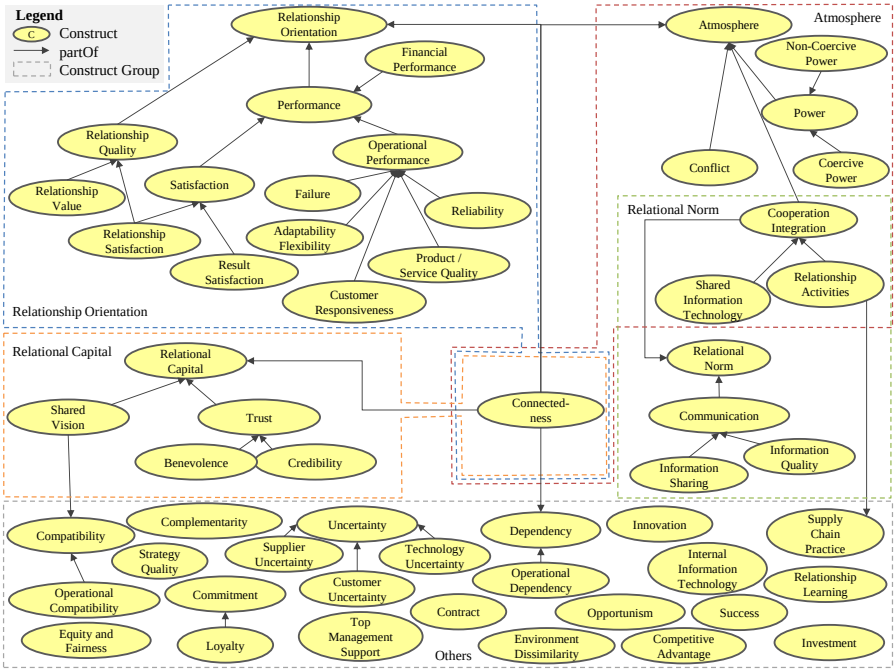


Fig. 9: Success factors organized in a hierarchical structure. Note that this figure illustrates only part-of relationships but does not yet show influencing relationships since at this step we concentrate on defining and organizing constructs.

5 Derivation of the Influencing Relationship Model

Based on the literature review and the grouping of constructs and their influencing relationships a hierarchical structure has been found. The hierarchical structure consists of constructs as well as relationships between these constructs. The relationships are either part-of relationships or influencing relationships. Based on this hierarchical structure the second step for simplifying the constructs and their relationships can be applied. This includes applying inference as well as redundancy checking rules. The application of inference rules helps inferring additional influencing relationships which are not explicitly found in literature studies. By applying these inference rules we can obtain a complete model of all constructs including the influencing relationships among the constructs. Inferring a complete set of knowledge before

performing redundancy checking ensures that all relationships are taken into account and that no knowledge is lost. Let's consider the case of inference rule #4 (cf. Figure 10) where all sub-constructs (y_1, y_2, y_3, ... y_n) of x influence an additional construct z. If there is no inference of their main construct x on the additional construct z, at the time of redundancy checking the relationships of sub-constructs will not be removed since there is no influencing relationship of their main constructs to this additional construct. In the following, inference rules and redundancy checking rules are discussed. The technical implementation regarding the application of these rules as well as the results are discussed afterward.

5.1 Inference Rules

The inference rules consider both types of relationships between constructs for deriving additional knowledge. These include influencing relationships as well as part-of relationships. We developed four inference rules, as illustrated in Figure 10.

Rule #1 and Rule #2 infer influencing relationships from constructs, i.e. main constructs, which are comprised of either one or more other constructs, i.e. sub-constructs. For instance, the construct *Trust* consists of the constructs *Credibility* and *Benevolence*. In other words, *Credibility* and *Benevolence* are sub-constructs of *Trust*. Moreover, Rule #1 specifies that if an additional construct influences the main construct then this additional construct also influences the sub-construct. For instance, applied to the running example, if the additional construct named *Adaptability* influences *Trust*, then we also perceive that *Adaptability* influences *Credibility* and *Benevolence*. Similarly, Rule #2 specifies that if the main construct influences an additional construct, then the sub-construct also influences the additional construct. For instance, applied to the running example, if *Trust* influences the additional construct named *Adaptability*, then we also perceive that *Credibility* and *Benevolence* influence *Adaptability*. These properties are reflected by rule#1 and #2. Formally, the first two rules are expressed as follows:

Rule #1: If y is a part of x, and z influences x, then it implies z influences y.

Rule #2: If y is a part of x, and x influences z, then it implies y influences z.

Rule #3 and #4 are inference rules for deriving additional knowledge. In contrast to rules #1 and #2, the rules #3 and #4 infer additional knowledge from the relationships of the sub-constructs. In particular, for rule #3, it is important to note that only if an additional construct influences all sub-constructs then the additional construct also influences the main construct. For example, if *Performance* influences *Credibility* and *Benevolence*, then it infers that *Performance* also influences *Trust*. Similarly, if all sub-constructs influence an additional construct, then the main construct also influences the

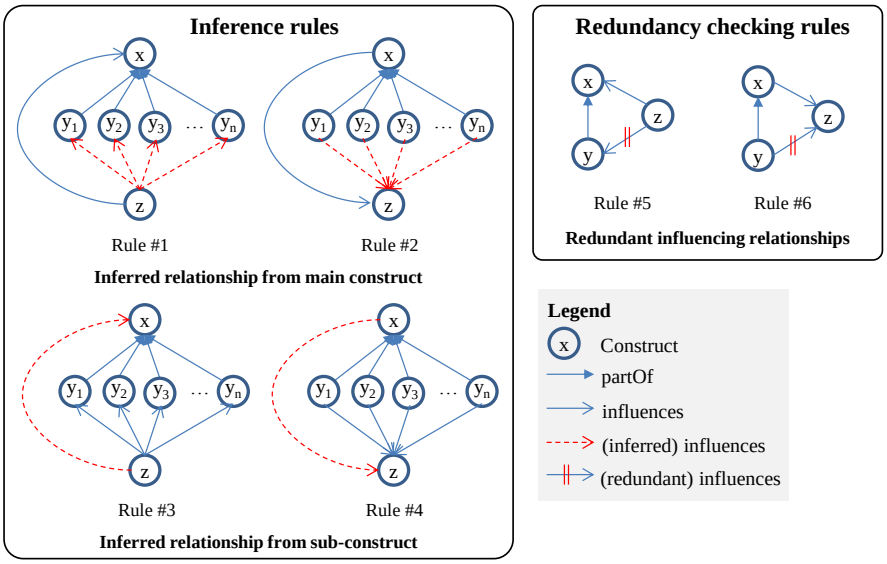


Fig. 10: Inference rules and redundancy checking rules

additional construct. For instance, if *Credibility* and *Benevolence* influence *Performance*, then it also infers that *Trust* influences *Performance*. These properties are represented by Rule #3 and Rule #4.

Rule #3: If $y_1, y_2, y_3 ... y_n$ are a part of x, and for every part of x, there is an influencing relationship from z to each part, then it implies z influences x.

Rule #4: If $y_1, y_2, y_3 ... y_n$ are a part of x, and for every part of x, there is an influencing relationship from each part to z, then it implies x influences z.

After applying these four inference rules we obtain a complete set of influencing relationships between the different constructs. In summary there are 986 influencing relationships among 56 constructs derived after applying inference rules. This servers as a basis for applying redundancy checking rules, as discussed in the next sections.

5.2 Redundancy Checking Rules

The overall aim of this step is deriving a minimum set of influencing relationships which are necessary for inferring the complete set of influencing relationships by applying the aforementioned inference rules. For this reason, we perform a redundancy checking step to remove redundant influencing relationships that can be inferred by the inference rules.

Considering the inference rules, the influencing relationships of a main construct also cover the influencing relationships of its sub-constructs. This means that all influencing relationships of the sub-constructs can be safely eliminated since all of this information can be inferred again based on the influencing relationships of the main construct. For instance, the influencing relationship from *Performance* to *Trust* covers the influencing relationships from *Performance* to *Credibility* and from *Performance* to *Benevolence*. Hence, in this case, the influencing relationships between *Performance* and the sub-constructs of *Trust* (i.e., *Credibility* and *Benevolence*) are considered as redundant.

In order to remove redundant relationships we define two redundancy checking rules as shown in Figure 10, Redundancy checking rules. These rules, i.e. Rule #5 and Rule #6, are described as follows:

Rule #5: If y is a part of x, z influences x and z influences y, then z influences y is a redundant relationship.

Rule #6: If y is a part of x, x influences z and y influences z, then y influences z is a redundant relationship.

5.3 Implementation and Results

The implementation of these steps is achieved by applying a reasoning mechanism based on the inference and redundancy checking rules introduced earlier. The reasoning mechanism is implemented by the DLV system [4] (Leone et al, 2006b) which is a Datalog-based engine. In this work, the inputs are (i) constructs (cf. Fig. 9) with part-of relationships as well as their influencing relationships, and (ii) the inference rules and redundancy checking rules. These inputs are manually modeled in the form of logical rules expressed by using Datalog syntax as shown in Table 4. In particular, constructs and their hierarchical structure are modeled as facts which are expressed as *partOf* expressions (cf. Table 4, *partOf* expression). Moreover, we manually define equivalence expressions for indicating all parts of main constructs. For instance, we define the equivalence expression `equiv_3("Performance", "FinancialPerformance", "OperationalPerformance", "Satisfaction")` to express that *Performance* consists of three constructs: *FinancialPerformance*, *OperationalPerformance*, and *Satisfaction*. The facts of influencing relationships are defined as *inf* expressions as depicted in Table 4, *inf* expression. Inference rules and redundancy checking rules presented earlier are defined as shown in Table 4, Rule #1 - #6. In addition, we define the transitive property for part-of relationships as expressed in Table 4, *partOf* relationship. Moreover, the additional rule to derive essential influencing relationship (cf. Table 4, Essential relationship) is defined for identifying influencing relationships which are not redundant.

[4] `http://www.dlvsystem.com/`

Facts (Regarding Hierarchical Structure of Constructs)	**Remark**
partOf("OperationalPerformance", "Performance"). partOf("FinancialPerformance", "Performance"). partOf("Satisfaction", "Performance"). partOf("Credibility", "Trust"). partOf("Benevolence", "Trust").	*partOf* expression
equiv_3("Performance", "FinancialPerformance", "OperationalPerformance", "Satisfaction"). equiv_2("Trust", "Credibility", "Benevolence").	*equiv* expression
Facts (Influencing Relationships Resulting from Grouping Step)	**Remark**
inf("Trust", "Performance"). inf("Trust", "OperationalPerformance").	*inf* expression
Inference Rules	**Remark**
partOf(X, Z) :- partOf(X, Y), partOf(Y, Z).	*partOf* relationship
inf(Z, Y) :- inf(Z, X), partOf(Y, X).	Rule #1
inf(Y, Z) :- inf(X, Z), partOf(Y, X).	Rule #2
inf(Z, X) :- equiv_1(X, Y1), inf(Z, Y1). inf(Z, X) :- equiv_2(X, Y1, Y2), inf(Z, Y1), inf(Z, Y2). inf(Z, X) :- equiv_3(X, Y1, Y2, Y3), inf(Z, Y1), inf(Z, Y2), inf(Z, Y3).	Rule #3
inf(X, Z) :- equiv_1(X, Y1), inf(Y1, Z). inf(X, Z) :- equiv_2(X, Y1, Y2), inf(Y1, Z), inf(Y2, Z). inf(X, Z) :- equiv_3(X, Y1, Y2, Y3), inf(Y1, Z), inf(Y2, Z), inf(Y3, Z).	Rule #4
Redundancy Checking Rules	**Remark**
redun_inf(Z, Y) :- inf(Z, X), partOf(Y, X), inf(Z, Y).	Rule #5
redun_inf(Y, Z) :- inf(X, Z), partOf(Y, X), inf(Y, Z).	Rule #6
essential_inf(X, Y) :- inf(X, Y), not redun_inf(X, Y).	Essential relationship

Table 4: Facts and rules in Datalog syntax (Excerpt)

The aforementioned inference and redundancy checking rules are applied over the facts by using reasoning techniques. After reasoning, we retrieve essential influencing relationships (i.e., *essential_inf*) which are necessary for further deriving other influencing relationships by using the inference rules. In total, there are 126 essential influencing relationships as illustrated in Figure 11, representing the cause and effect model of inter-organizational success factors. In other words, this model shows a minimum set of influencing relationships (i.e., 126 relationships) which is required to infer the complete set of influencing relationships (i.e., 986 relationships).

In the model shown in Figure 11, an arrow describes a directed influencing relationship. For example, the arrow from *Trust* to *Contract* means that *Trust* influences *Contract*. Moreover, the influencing relationships of sub-constructs can be derived using the inference rules and based on the part-of relationships of the main construct. For instance, applied to the running example, that *Trust* influences *Contract*, can imply that *Credibility* and *Benevolence* also influence *Contract* since they are sub-constructs of *Trust* (according to Rule #2).

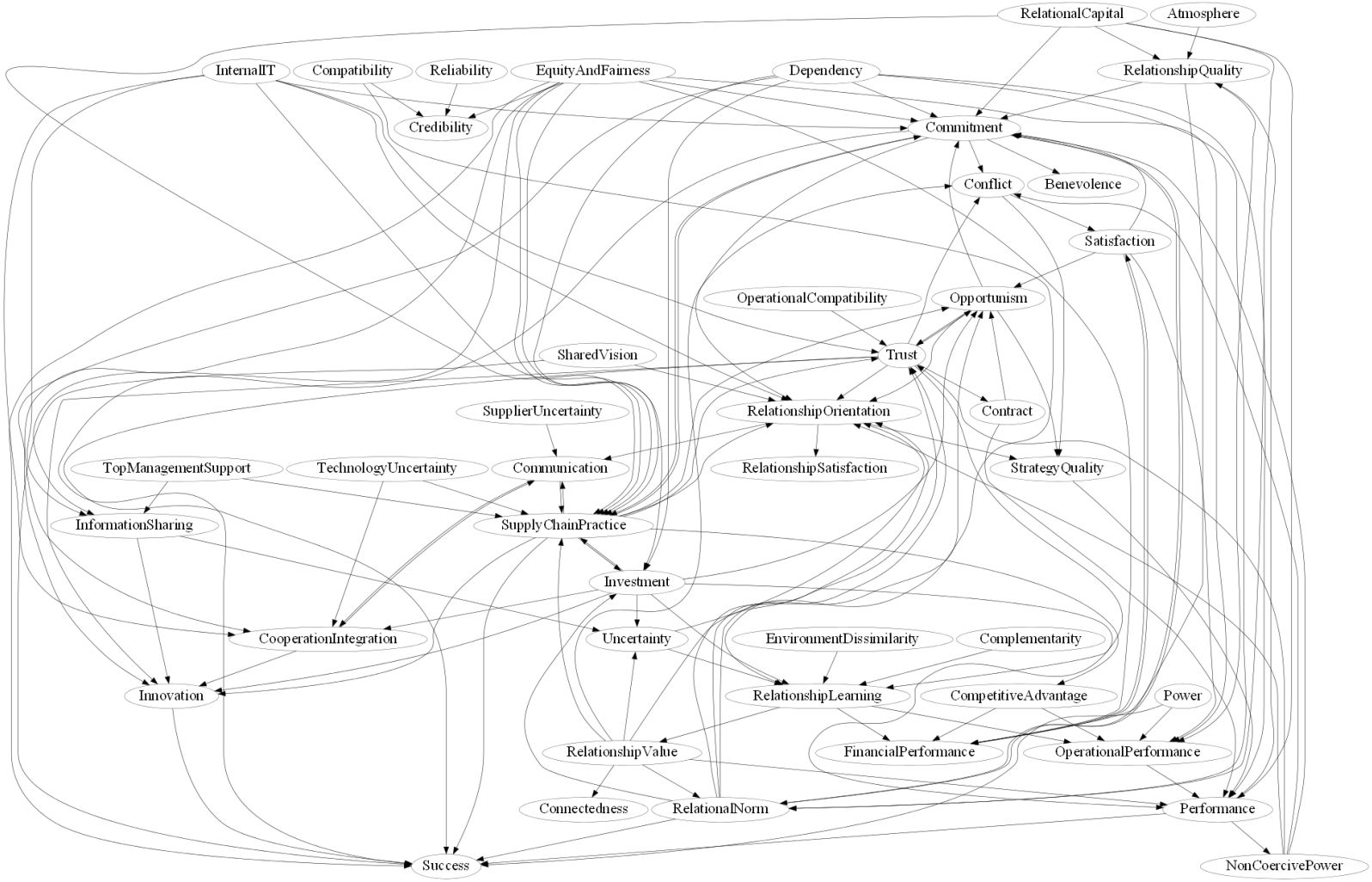


Fig. 11: Cause and effect model: Influencing relationships between constructs. In this figure, we concentrate only on a minimum set of influencing relationships between constructs which, in turn, are already derived by considering part-of relationships. Therefore, this graph shows only influencing relationships and excludes part-of relationships (i.e., hierarchical structure). Moreover, constructs having no influencing relationships belonging to this minimum set are also excluded.

	Constructs	Influencing Relationships
Literature Review	88	261
Grouping Constructs and Relationships	56	212
Applying Inference Rules	56	986
Applying Redundancy Checking Rules	56	126

Table 5: Results after grouping constructs and refining relationships

5.4 Summary of the Influencing Relationship Model

Based on the hierarchical structure inference, the redundancy checking rules have been applied as described above. The aim of applying these rules is the simplification of the hierarchical structure containing the constructs and the minimum number of influencing relationships. The results of the simplification are presented in Table 5. After applying the inference rules for deriving additional knowledge, the number of influencing relationships increased from 212 to 986. Afterwards, the redundancy checking rules have been applied for reducing the total number of influencing relationships to the minimum number of 126 relationships.

6 Analysis and Implications

Based on the obtained model shown in 11, we analyze the most influencing constructs as well as the mostly influenced constructs. In doing so, we firstly derive the complete model of influencing relationships between the 56 constructs by applying inference rules (cf. Fig. 10) on the cause and effect model (cf. Fig. 11). Then, we apply network analysis techniques to the complete model. Here, we study the complete model because it shows all influences explicitly without having to consider the part-of relationships again since, at the time of inferring the complete model, the part-of relationships are already taken into account through inference rules (cf. Fig. 10).

In particular, we perform an analysis of degree centrality, and distinguish between out-degree and in-degree centrality since the model is directed (Newman, 2010). Out-degree and in-degree analysis can provide a straightforward answer regarding the most influencing and the mostly influenced constructs by looking at the numbers of outgoing and incoming relationships. In other words, the out-degree of a construct is the number of times that the construct appears as a source of an influencing relationship. In-degree analysis investigates the number of incoming influencing relationships or the number of times that the construct appears as a target of an influencing relationship.

As some constructs are comprised of sub-constructs, the network exhibits a hierarchical structure, which makes the interpretation of results complicated and maybe ambiguous. This is why we focus on in- and out-degree centrality; as opposed to other centrality measures such as betweenness centrality (counting the number of times a node in the network bridges two other nodes on their shortest paths) and closeness centrality (computing the total distance of a node

Rank	Out-Degree	Construct(s)
1	32	InformationSharing
2	31	Benevolence, Credibility, RelationshipValue, Trust
3	28	RelationshipActivities, SharedVision, SupplyChainPractice
4	27	Communication, CooperationIntegration, InformationQuality, SharedIT
5	26	Commitment, Connectedness, Loyalty
6	25	InternalIT
7	23	Dependency, OperationDependency, RelationalCapital, RelationalNorm
8	22	Investment, NonCoercivePower
9	21	Opportunism
10	20	Reliability, TechnologyUncertainty
11	19	AdaptabilityFlexibility, CustomerResponsiveness, Failure, OperationalPerformance, ProductServiceQuality, RelationshipSatisfaction, ResultSatisfaction, Satisfaction, SupplierUncertainty
12	17	EquityAndFairness
13	16	CustomerUncertainty, Uncertainty
14	14	RelationshipQuality
15	12	Contract
16	11	FinancialPerformance, StrategyQuality
17	10	CoercivePower, Power
18	9	Performance
19	8	RelationshipLearning
20	7	CompetitiveAdvantage
21	6	Conflict
22	5	RelationshipOrientation
23	4	OperationalCompatibility
24	3	Atmosphere, TopManagmentSupport
25	2	Compatibility
26	1	Complementarity, EnvironmentDissimilarity, Innovation
27	0	Success

Table 6: Out-degree rank

to all other nodes in the network) the interpretation of in- and out-degree is straightforward. The analysis and the visualization of the results are realized using the software Gephi (Bastian et al, 2009).

6.1 Out-degree Analysis

The ranking of constructs by out-degree indicates which constructs influence other constructs the most. The results of the out-degree analysis are illustrated in Figure 12. Each circle represents a particular construct and its label the name of the construct. The size of a circle visualizes the number of outgoing influencing relationships. That is, the higher the number of outgoing relationships the bigger the circle. Moreover, the positions of constructs are also organized according to their number of outgoing relationships and their group. In other words, constructs having a high number of outgoing relationships are positioned near the center of the graph. Constructs belonging to the same group are located near each other. Furthermore, Table 6 provides details on the ranking by out-degree. From the result, the top ranked constructs in terms of out-degree include three main groups which are *Relational Capital*, *Relational Norm*, and *Commitment*. This implies that those three groups of constructs influence many inter-organizational success factors.

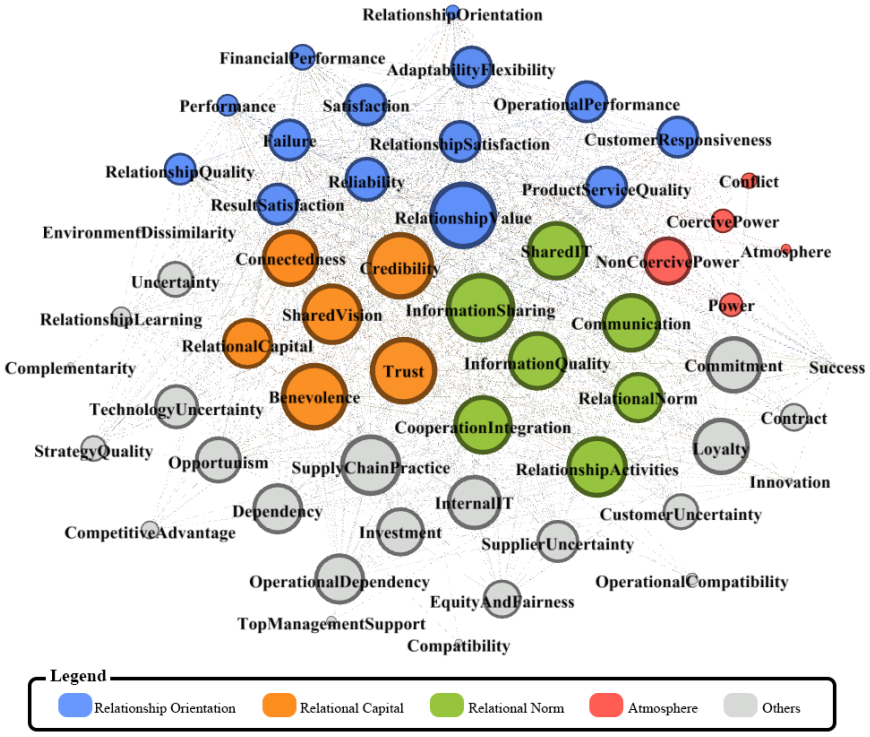


Fig. 12: Graph shows constructs ranked by out-degree. A circle represents a construct and the size of the circle represents its in-degree. The positions of constructs are also arranged according to their in-degree and their group.

Every part of *Relational Capital* is found to have a considerably high out-degree as well. These include *Trust* with its dimensions *Credibility* and *Benevolence*, *Shared Vision*, and *Connectedness*. Similarly, *Commitment* as well as its part *Loyalty* are also in a top rank in regards to out-degree. This shows that trustworthiness and faithfulness in business partners are important for developing IORs since they are the basis of several other success factors.

Furthermore, *Relational Norm* including *Communication* (and its dimensions *Information Sharing* and *Information Quality*) and *Cooperation and Integration* (including *Shared IT* and *Relationship Activities*) also play an important role as a source to drive other success factors since they have a high out-degree as well. Moreover, the out-degree of *Supply Chain Practice*, *Relationship Value*, and *Internal IT* are also high enough to be considered as antecedences of other success factors.

In summary, in order to improve IORs, organizations should consider maintaining or improving success factors in the groups of *Relational Capital*, *Relational Norm*, *Commitment* and the success factor *Shared IT* as well as implementing the *Supply Chain Practice*. Moreover, they should periodically en-

courage and promote *Relationship Value* among business partners since it can motivate business collaboration.

The result mainly indicates that trustworthiness, loyalty, communication, cooperation and relationship values are necessary for maintaining and improving IORs. If organizations deceive their business partners, this may result in losing trustworthiness and loyalty from their business partners and in turn negatively affect their relationships. Similarly, lack of good collaboration and communication may result in poor business operations which consequently leads to business loss and finally harms IORs. Therefore, organizations should do business with their integrity and sincerity as well as continuously maintain and improve their communication and cooperation with business partners. It notably shows some similarities with insights from game theory (von Neumann and Morgenstern, 2007), especially the case of repeated games. Trustworthiness leads to the cooperation, and cooperation leads to better outcome for all participants in the game (Meaklim, 2013). However, without enough trust to cooperate one may start to act only for the benefit of themselves. One way to enable the cooperation is to encourage the value of relationships (Meaklim, 2013). Once when participants understand benefits and outcomes from their relationships, they may start or improve their business collaboration.

Furthermore, the result shows the importance of information technology on the success of IORs, especially *Shared IT*. The use of shared information systems, such as supply chain management systems and shared enterprise resource planning systems, improves the communication between organizations (Ryssel et al, 2000). In other words, it facilitates the communication among business partners and hence, it accelerates joint business activities and collaboration (Paulraj et al, 2008). Such an instant benefit from sharing IT through the entire supply chain may lead to the substantial benefit and improvement. This has been shown in many cases, e.g., Chrysler, Dell, Ford, and Wal-Mart. They made a significant investment on supply chain management systems supporting the collaboration with their suppliers which in turn created quite a benefit (Subramani, 2004).

6.2 In-degree Analysis

Figure 13 illustrates the ranking of the constructs by in-degree. The details on their in-degree distribution is provided in Table 7. Similar to the out-degree analysis the circles represent constructs. However, in the case of the in-degree analysis, the size of the circles represents the number of incoming influencing relationships. In other words, the bigger the circle, the higher the construct is influenced by other constructs. The position of constructs corresponds to the number of incoming relationships as well as the group of the construct.

Most of the constructs under the group of *Relationship Orientation* have a high in-degree. Those include *Relationship Quality*, and *Performance*. The construct *Performance* contains the sub-constructs *Financial Performance*, *Operational Performance*, and *Satisfaction*. Noteworthy constructs are also the sub-

Rank	In-Degree	Construct(s)
1	46	RelationshipSatisfaction
2	44	AdaptabilityFlexibility, CustomerResponsiveness, Failure, OperationalPerformance, ProductServiceQuality, Reliability
3	42	FinancialPerformance
4	39	RelationshipValue
5	38	RelationshipQuality
6	37	ResultSatisfaction, Satisfaction
7	35	Performance
8	32	InformationSharing
9	30	Success
10	29	Communication, InformationQuality
11	25	Commitment, Loyalty
12	22	Connectedness
13	21	RelationshipOrientation
14	19	RelationshipActivities, SupplyChainPractice
15	18	CooperationIntegration, SharedIT
16	17	Credibility, StrategyQuality
17	16	Opportunism
18	15	Benevolence
19	13	RelationshipLearning, Trust
20	12	Innovation, Investment
21	11	NonCoercivePower, RelationalNorm
22	7	Conflict
23	3	Contract, CustomerUncertainty, SupplierUncertainty, TechnologyUncertainty, Uncertainty
24	2	CompetitiveAdvantage
25	0	Atmosphere, CoercivePower, Compatibility, Complementarity, Dependency, EnvironmentDissimilarity, EquityAndFairness, InternalIT, OperationalCompatibility, OperationalDependency, Power, RelationalCapital, SharedVision, TopManagementSupport

Table 7: In-degree rank

constructs of *Operational Performance*, which include *Adaptability/Flexibility*, *Failure*, *Customer Responsiveness*, *Reliability*, and *Product/Service Quality*. Furthermore, a high in-degree is also shown in the sub-constructs of satisfaction which contains *Result Satisfaction* as well as *Relationship Satisfaction*.

These constructs can be considered as consequences of other inter-organizational success factors. The result implies that the constructs in the group of *Relationship Orientation* tend to rely on other constructs. In other words, they require support from other constructs in order to be achieved and fulfilled.

Surprisingly, *Success* does not appear as the highest in-degree construct, but instead the constructs under the group of *Relationship Orientation* does. The reason is that best to our understanding most of the studies reviewed often use the constructs of the group *Relationship Orientation* for assessing the success of IORs. Generally speaking, this implies that the success of IORs can be reflected by the constructs under the group of *Relationship Orientation* (i.e. *Performance* and *Relationship Quality* as well as their sub-constructs).

Furthermore, there are no incoming relationships found for the following constructs: *Atmosphere* and some of its parts (i.e., *Power* and *Coercive Power*), *Compatibility* including strategic and operational compatibility (i.e., *Shared Vision* and *Operational Compatibility*), *Dependency* and its part *Operational Dependency*, *Environment Dissimilarity*, *Equity and Fairness*, *Inter-*

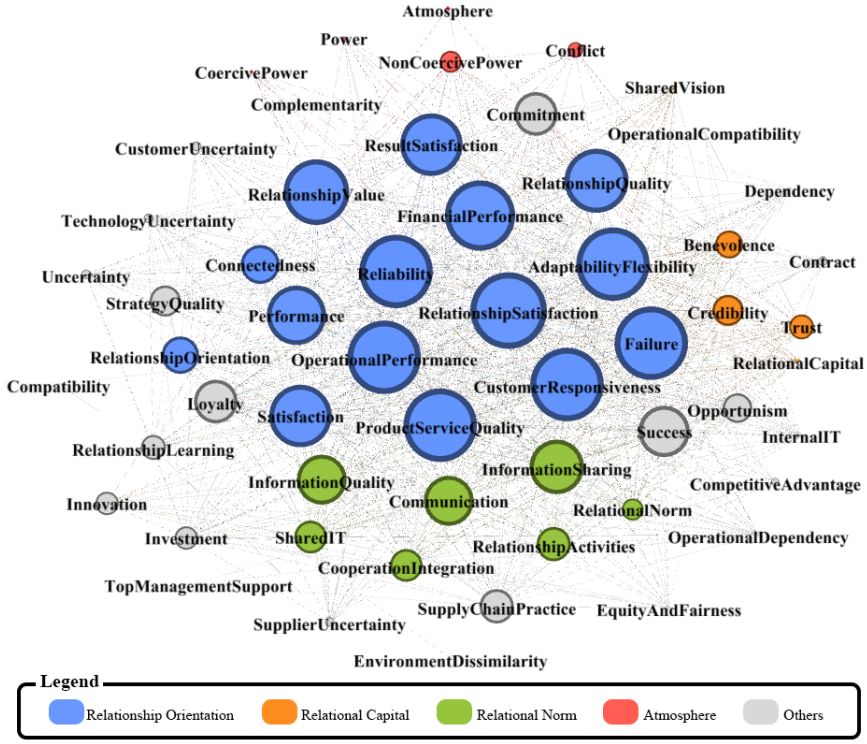


Fig. 13: Graph shows constructs ranked by in-degree. A circle represents a construct and the size of the circle represents its in-degree. The positions of constructs are also arranged according to their in-degree and their group.

nal Information Technology, as well as *Top Management Support*. This implies that these constructs are not influenced by any other constructs, but they may be influenced by some other factors, such as people or the nature of business itself, which are not included in this study. For example, *Compatibility* and *Environment Dissimilarity* may depend on the nature of business or the diversity of environment (e.g., markets, resources, geography, etc.). *Atmosphere* and *Top Management Support* may be influenced by people and culture in organizations which are beyond the scope of this paper.

7 Discussion and Future Work

This paper presents a review which aims at identifying inter-organizational success factors and their influencing relationships affecting inter-organizational relationships (IORs). We conducted a systematic literature review covering 177 publications for identifying success factors related to IORs. The success factors have been integrated and consolidated into a cause and effect model. Conse-

quently, the resulting cause and effect model served as a basis for analyzing the most influential and most influenced success factors.

The success factors found in literature have been grouped according to their definitions and measurements resulting a hierarchical structure. This structure served as a basis for applying inference rules for deriving additional knowledge not explicitly addressed in literature. The resulting structure containing additional inferred knowledge has been simplified by applying redundancy checking rules which eliminate duplicate information. The resulting constructs as well as their minimum set of influencing relationships are presented in the cause and effect model in Figure 11.

The cause and effect model has further been analyzed in terms of out-degree and in-degree analysis. This allows identifying the most influencing as well as the most influenced constructs. The results of the out-degree analysis show that the success factors in the groups *Relational Capital*, *Relational Norm*, *Commitment* as well as the success factors *Supply Chain Practices*, *Shared Information Technology* and *Relationship Value* are the most influencing success factors in IORs. The results of the in-degree analysis show that the success factors in the *Relationship Orientation* group tend to be the most influenced success factors.

The cause and effect model presented in this paper explains the influencing relationships between success factors. However, it does not indicate the tendency of relationships (i.e. positive relationships or negative relationships). Nevertheless, this review provides an understanding of success factors in IORs as well as the directed influencing relationships between success factors.

Moreover, since this work is based on the review of scientific publications and not "primary" data, the validation of the cause and effect model presented still remains for future work. This includes empirical studies for (i) validating influencing relationships presented in the model, and (ii) exploring the extent or the phenomenon to which those relationships are valid. This is challenging since the model is large, consisting of numerous success factors. In particular, it is difficult to find a single case study covering all success factors appearing in the model. Thus, multiple case studies may be required to test some parts of the model separately. However, the integration and the interpretation of results derived from those studies may also be difficult since several aspects (e.g., business domain, organizational structure, etc.) should be considered carefully for deriving an accurate result. Thus, the validation of the model remains open and subject to further research. We would like to encourage researchers who are interested in this work to improve, extend, or validate the presented model. The validated model might be useful for organizations as a strategic guideline to manage the right success factors playing key roles in inter-organizational success.

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