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A qualitative approach to assess the alignment of Value Systems in collaborative enterprises networks

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ABSTRACT

Collaborative enterprises networks are composed of heterogeneous and autonomous enterprises, which are often geographically distributed. As such, it is natural that each enterprise has its own set of values and preferences and as a result, conflicts among partners might emerge due to some values misalignment. Therefore, tools to support the analysis of Value Systems and their alignment in a collaborative context are relevant to improve the network management. Since a Value System reflects the set of values and preferences of an actor, which are cognitive issues, a cognitive analysis approach based on fuzzy causal maps is introduced. A set of qualitative assessment methods are designed to properly capture and integrate multiple perspectives about the concept of Value Systems alignment, in order to improve the identification and assessment of Value Systems misalignments in the context of collaborative enterprises networks. A web based tool to support these qualitative models and methods in a integrated way is used in a case study. Finally, experimental results are presented and discussed.

1. Introduction

Business environments have been facing tough challenges in recent years, which, combined with the new possibilities provided by advances in information and communication technologies, are leading to the emergence of a large variety of collaborative networks. Literature in last decades has pointed out that the participation in a collaborative process brings benefits to the entities involved (Carlton & Perloff, 2000; Chen, Huang, & Lai, 2009; Chituc & Nof, 2007; Porter, 1980). These benefits include not only an increase in "survival capability" in a context of market turbulence, but also the possibility to better achieve common goals (Chituc & Nof, 2007; Fujii, Kaihara, & Morita, 2000; Huang & Wu, 2003). However, empirical studies also show that many inter-enterprises collaboration initiatives fail (Bamford, Ernst, & Fubini, 2004; Kelly, Schaan, & Joncas, 2002). In fact, a number of requirements are needed to create successful collaborative coalitions, including: sharing of goals among members, having reached a level of mutual trust, having created some common infrastructures and having agreed, totally or partially, on some practices and values (Bititci et al., 2007; Camarinha-Matos, Afsarmanesh, Galeano, & Molina, 2009).

Of particular relevance in collaboration are the values that derive the behavior of the participants. In Psychology and Sociology, values have typically been conceptualized as shared beliefs about desired behaviors and end-states (Rokeach, 1973). These shared beliefs address goal pursuit processes and outcomes. Moreover, Merton (1957) advocates that the cultural objectives of an organizational unit are the "things worth striving for" – the things that are valued. Value has also been defined as "relative worth, utility, or importance: degree of excellence" (Meriam-Webster, 2004). This definition highlights the fact that an object's value depends on the referential that is used in the evaluation. Depending on the referential, the same object may be valued differently. Thus, inside an organization, cultural and social values are used as the referential for evaluations and consequently for decision-making (Annebicque, Crevits, Poulain, Debernard, & Millot, 2009). In the case of partnerships, if organizations have different values, they will have a different perception of outcomes, which might lead to non-collaborative behavior and inter-organizational conflicts (Findlay-Brooks, Visser, & Wright, 2007; Stott, 2007).

It is often stated that the alignment among the members involved in collaborative processes is a pre-requisite for successfully co-working. However, the concept of "values alignment" is difficult to define. Nevertheless, it can be intuitively understood that when the core values of one member are incompatible with the core values of another, there is a misalignment and the potential for conflict is high. Reciprocally, when the core values of one member are compatible with the core values of another member, there is an alignment and the potential for emergence of conflicts is low (Adkins, Ravlin, & Meglino, 1996; Jehn, Chadwick, & Thatcher, 1993; Kehoe & Ponting, 2003). Although, the existence of a total alignment does not imply the total elimination of conflicts, an

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assessment of the level of values alignment enables the causes for conflicts to be better understood and thus mechanisms may be designed for the progressive resolution of problems. Consequently, the level of alignment might work as a predictive indicator of the capacity that a coalition has for reaching agreements when conflicts arise during a collaborative process. In this sense, the ability to quickly identify partners with a strong values alignment can represent an important boost for successful coalition formation.

How to model values? In engineering, models are the starting point to analyze, design and build any artifact. In this case, the development of models to represent values, priorities and evaluation mechanisms in the context of partnerships will be the starting point to analyze "values alignment" among potential partners, and to design methods and tools to support "values alignment" management in collaborative contexts. Behavioral researchers (Budescu & Wallsten, 1985; Olson, Moshkovich, & Schellenberger, 1995) have concluded that qualitative models have the advantage of being close to natural language; thus, decision makers and experts can easily understand the model, which will increase the confidence on the outputs. However, a consistent qualitative approach to analyze Value Systems alignment has not yet been explored. Thus, the aim of this research work is to design qualitative assessment methods to properly capture and integrate multiple perspectives about the Value Systems alignment concept in order to identify and assess potential misalignments in collaborative enterprises networks. This research adopts the approach proposed by Kosko (1986) on fuzzy causal maps to specify the influences among core values. Furthermore, the use of a combination of graphs and fuzzy causal maps to model the interactions among core values, organizations and collaborative networks is discussed, in order to analyze the alignment level. The design of the assessment methods takes as reference the work developed on qualitative operators for reasoning maps by Montibeller and Belton (2009).

The remainder of the article is outlined as follows. A brief summary of the background work on causal maps and qualitative reasoning is presented in Section 2. Section 3 introduces the qualitative conceptual modeling framework used as the base for Value Systems alignment analysis. Section 4 presents a brief introduction to Value System alignment related work. In Section 5, follows the description of the assessment methods. The proposed methods are then applied in a case study developed in the context of the European ECOLEAD project, as presented in Section 6. The last section draws some conclusions and outlines directions for further research in this area.

2. Background on Value Systems alignment assessment

Value Systems alignment within an organizational context is a topic that has been addressed essentially by social researchers. However, as *alignment* is a very broad concept involving notions such as consistency, fit, and similar ideas, there is not yet a consensus about the definition of the Value Systems alignment concept among the various researchers that have addressed this topic. In fact, in most cases the notion of "Value Systems alignment" refers to the consistency or compatibility between two sets of values, namely:

1. Between the personal exposed values and personal lived values. This alignment notion is usually called *individual alignment* (Harshman & Harshman, 1999; Schein, 1996), or *personal alignment* (Barrett, 2006).
2. Between existing organizational values and desired organizational values (Badovick & Beatty, 1987; Colins & Chippendale, 1995).
3. Between the set of values of one individual and another individual (Meglino & Ravlin, 1998). The idea of shared values as criteria of alignment is commonly accepted by social researchers (Badovick & Beatty, 1987).
4. Between members' values and organization's values (Colins & Chippendale, 1995; Hultman & Gellermann, 2002; Krishnan, 2005). Some authors call this kind of alignment as interpersonal alignment (Barrett, 2006).
5. Between organizational values and strategy or goals values (Colins & Chippendale, 1995; Hultman & Gellermann, 2002; Krishnan, 2005).

Moreover, there is no commonly accepted terminology: *values alignment*, *interpersonal alignment*, *core values alignment*, and *organizational alignment* are just some examples of other terms found in literature that refer to similar notions.

Most of the works on Value Systems alignment do not offer specific methods to calculate or express, quantitatively or qualitatively, the level of alignment, but rather discuss its importance and the ways to reach it. For instance, Brian Hall (1995) and Barrett (2006) defend the importance of core values held by organization's members to be aligned with the core values of the organization. Hall does not develop specific indicators to "measure" the Value Systems alignment, rather his proposal is oriented to organizational transformation. Under this perspective he defends that organizations should change their set of core values in order to fit a specific profile that copes with the organizational goals and strategy. On his turn, Barrett considers three types of alignment: (i) the consistency between the personal exposed values and personal lived values; (ii) the consistency between members' values and the organization's current values; (iii) the consistency between the organization's current values and the desired organization's values. In this line he developed a framework – *The Seven Levels of Conscientiousness* to support the alignment assessment. The core values identified as personal values, current cultural values, and desired cultural values, are mapped onto the framework, where a descriptive assessment is made by comparing the resulted maps.

Furthermore, Badovick and Beatty (1987) and Krishnan (2005) propose quantitative indicators to measure organization's values alignment. In fact, Badovick and Beatty specified two indicators: (i) Value congruence, which is defined as the level of agreement between the perceived individuals' values and their desired values; (ii) Value consistency, which is calculated by a paired *t*-test (an inferential statistics method that assesses whether the means of two groups are *statistically* different from each other) between means for each value. The value congruence indicator represents the degree to which members of the organization are in personal agreement with what they perceive to be the core values of the organization, while the value consistency represents the perception about the amount of core values shared among individuals. In his work, Krishnan proposes an indicator to represent the alignment between leader's Value System and follower's Value System. This indicator measures the similarity between the two Value Systems, each one being represented by a vector of core values and the similarity level is given by the cosine of the angle between these two vectors.

Table 1 presents an overview of the strengths and weaknesses of the main models found in literature for Value Systems alignment assessment. This summary, which is based on a set of significant characteristics, allows us to conclude that none of these models proposes a qualitative modeling approach or supports the alignment assessment specifically in collaborative networks contexts.

3. Background on causal modeling and qualitative reasoning

Causal models are an extension of graph theory, which emerged due to the need for a sketching technique to support and facilitate reasoning about cause and effect. Causal maps (Chaib-draa, 2002;

Table 1
Brief summary analysis of models for the assessment of Value Systems alignment.

Author/ characteristics	Personal values alignment	Organizational values alignment	Network values alignment	Notion of similarity among values	Notion of shared value	Notion of compatibility	Quantitative indicators	Qualitative indicators
Hall (1995)	✓	✓	✓	✓	✓	×	×	×
Colins and Chippendale (1995)		✓	×	✓	✓	✓	×	×
Barrett (2006)	✓	✓	×	✓	✓	✓	×	×
Badovick and Beatty (1987)	×	✓	×	✓	✓	×	✓	×
Krishnan (2005)	✓	×	×	✓	✓	×	✓	×

Jenkins, 1994; Laukkanen, 1998), cognitive maps (Axelrod, 1976; Bouzdine-Chameeva, Durrieu, & Mandják, 2003; Chaib-draa, 2002; Eden, 1992b; Kosko, 1986; Miao & Liu, 2000), causal models (Greenland & Brumback, 2002; Pearl, 2000; Salles & Bredeweg, 2004) are examples of distinct terms that are often used to designate this common representation approach. In fact, the precursor work developed by Axelrod (1976) on causal maps was based on the following five fields: (i) psycho-logic, (ii) causal influence, (ii) graph theory, (iv) evaluation analysis, and (v) decision theory. The follow-up of these initial five contributions, gave rise to different forms of causal models, and consequently to different modeling and analysis approaches. In its essence, causal modeling builds upon a binary relationship, called an influence relationship, between two entities that represent named quantitative or qualitative values or value sets. Whereby changes in the influencing entity are conveyed as changes in the influenced entity. Causal modeling has been applied in cognitive sciences, management sciences and engineering (Chaib-draa, 2002; Eden, 1992b; Ennis, 1999; Hodgkinson, Bown, Maule, Glaister, & Pearman, 1999; Hsu & Sabherwal, 2011; Scavarda, Bouzdine-Chameeva, Goldstein, Hays, & Hill, 2006; Shaw, Eden, & Ackermann, 2009; Xirogiannis & Glykas, 2004) in order to evidence the causal relationship between some concepts.

Causal inference is concerned with determining the effect of a given cause concept on a given effect concept. The causal inference process can be performed in distinct ways, depending essentially on the approach adopted in causal modeling. One of the approaches coming from the field of Artificial Intelligence (AI), is the one of fuzzy cognitive maps (FCMs), which extend causal models in two important directions: (i) identifying which causes generate stronger effects (Kosko, 1986); and (ii) assessing the dynamic effects if a given cause happened (Kosko, 1997). Another approach stemming from the AI community considers causal maps as Qualitative Probabilistic Networks, in which each link denotes a probabilistic dependence and impacts are propagated across the map (Wellman, 1994). This kind of networks are common known by Bayesian Networks and have been used to draw inferences in causal maps (Pearl, 2000). Departing from the Bayesian Networks, Montibellier and Belton (2009) attempted to use a causal map structure to perform a multi-criteria evaluation of decision alternatives. They proposed a reasoning method (denominated reasoning map) that employs qualitative assessment of preferences providing qualitative outputs. This method uses aggregation operators for qualitative data, based on decision tables, where the user defines qualitative scales to reflect the performance of decision options and the strength of influences. Thus, one of the main advantages of this approach is the employment of a qualitative assessment that uses qualitative operators and provides qualitative outputs. In doing so, the method increases the accessibility of the method to managers, who use the verbal medium as their main communication tool and helps also to improve the confidence in the achieved results.

4. Core value system analysis framework

This section aims to introduce the V-AligN framework, which was developed based on the work previously presented in (Macedo, Abreu, & Camarinha-Matos, 2010) in order to support the qualitative analysis and assessment of Core Value Systems alignment in the context of Collaborative Networks. This framework presents a new way of looking at the values system alignment issue by adopting causal models and graphs to model Value Systems in collaborative context using a purely qualitative approach where the relationships are just qualitatively specified. A pure qualitative approach is selected for the following two main reasons: (i) lack of numeric information available in order to formulate a quantitative model; and (ii) the main goal is to have a qualitative description that provides a general perception of the network in order to address strategic business issues, rather than to have a detailed quantitative description.

In order to ease the CVSs alignment analysis process we need to develop formal mechanisms that facilitate our perception about: (i) the structure of the core values; (ii) the shared values among network members; (iii) the set of core values belonging to one entity that have a positive or negative impact on another set of core values belonging to another entity. Therefore, the visual representation of the distinct relationships among the following entities: core values, organizations, and collaborative networks, is a relevant requirement to facilitate understanding.

The V-AligN framework is based on the definition of three elementary maps as presented in Fig. 1, which are formally specified in Table 2. A core-values influence map is a cognitive fuzzy map where the intensity of the influence is specified using a qualitative label selected from a pre-defined partial ordered set. Organization's core-values maps and CN's core-values maps are graphs, where to each edge a qualitative label is associated that represents the degree of importance of the core-value to the organization or to the network.

5. Core Value Systems alignment assessment

5.1. Towards a set of alignment criteria

As mentioned above, alignment is a very broad concept which is related to consistency, fitness, and similar ideas. Therefore, in order to propose methods to analyze the alignment between CVSs in a collaborative context, it is necessary to first consider the factors that contribute to core values alignment and misalignment in that context.

Although we could not find any methods proposed in the literature to assess the Value Systems alignment in collaborative contexts, some previous works have given inputs to our research, namely: (i) the studies developed on the assessment of the compatibility between the set of values of one individual and that of

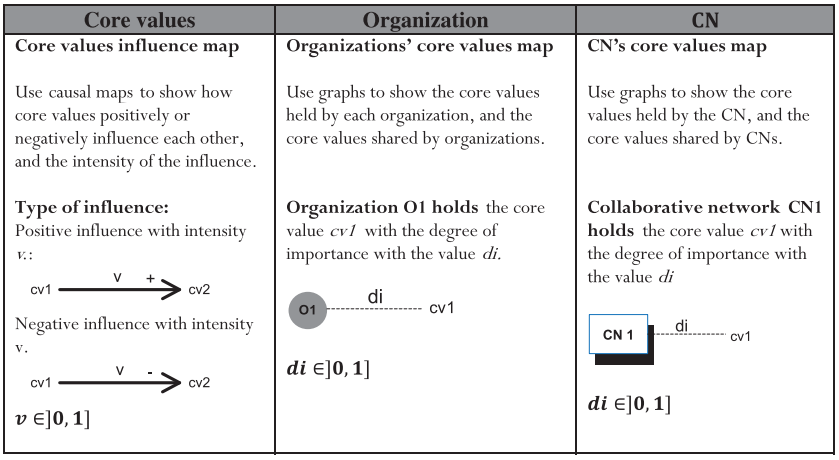


Fig. 1. Structural elements of the V-AligN framework.

Table 2
V-AligN framework: elementary maps specification.

Description	Formal specification
Core values influence map (CVIM) A causal map that represents the influence relationships among core values. Each node represents a core value, the direct-edge represents the influence relationship, which has associated a qualitative label that represents the strength of the influence, and a sign (+/−) that represent if the influence is either positive or negative	*CVIM* = (*CV*, *E*), where *CV* is the set of core values and *E* is the set of influences (direct-edges), such that$E = \{e_{ij} = (cv_i, cv_j, p, s): cv_i \in CV \wedge cv_j \in CV \wedge p \in P \wedge s \in S\}$ • *P* is a partial ordered set, such that: $P = \{low, moderate, high\}$ • $S = \{-1, +1\}$, where +1 represents a positive influence, and −1 a negative • influenceThe following operators are defined influenceValue: $E \rightarrow P \times S$, influenceValue$((cv_i, cv_j, p, s)) = (p, s)$ • sign: $E \rightarrow S$, sign$(cv_i, cv_j, p, s) = s$ • intensity: $E \rightarrow P$, intensity$(cv_i, cv_j, p, s) = p$
Organization's core values map (OCVM) A graph that shows the core values held by an organization. The edges of the graph also have different qualitative values associated according to the degree of importance of the core values	*OCVM* = (*V*, *OW*), where $V = CV \cup O$, such that *CV* is the set of core values and *O* is the set of organizations, and *OW* is a set of relations (direct-edges) defined as • $OW = \{ow_{ij} = (o_i, cv_j, p): o_i \in O \wedge cv_j \in CV \bigwedge p \in DI\}$ • DI is a partial ordered set representing the possible values for the degree of importanceThe *preference* operator returns the degree of importance of a core value for an organization • preference:$OW \rightarrow DI$, preference$(o, cv, p) = p$
CN's core values map (CCVM) A graph that represents the core values held by a collaborative network. The edges of the graph also have different qualitative values associated according to the degree of importance of the core values	*CCVM* = (*V*, *CW*), where: $V = CV \cup CN$, such that *CV* is the set of core values, *CN* is the set of *CN*s, and *CW* is a set of relations (edges) defined as • $CW = \{cw_{ij} = (cn_i, cv_j, p): cn_i \in CN \wedge cv_j \in CV \wedge p \in DI\}$ • *DI* is a partial ordered set representing the possible values for the degree of importance • The *preference* operator returns the degree of importance of a core-value for a *CN* • preference: $CW \rightarrow DI$, preference$(cn, cv, p) = p$

another individual (Meglino & Ravlin, 1998); (ii) the studies concerning the assessment between members' values and organization's values (Badovick & Beatty, 1987; Colins & Chippendale, 1995; Hultman & Gellermann, 2002; Krishnan, 2005).

Using the V-AligN framework presented above, it is easy to represent the shared core values among network members and between the network and each member. Nevertheless, the shared values criterion might not be enough to assess values alignment, since not only the shared values contribute to the sustainability of the collaboration. For instance, two actors may share the same core values and preferences, and if they believe that only one of them can maximize his core values through a collaborative process, in such case, no collaborative process can emerge based on these core values. Furthermore, there are a lot of successful cases of collaboration between entities that do not have the same core values and preferences. For example, a university and an industry can collaborate well in spite of not sharing the same core values, since the university has core values that influence positively the core values of the industry and vice versa. Therefore, in this work, the adopted approach for the assessment of the CVSs alignment considers not just a comparison between core values and priorities, but also an estimate of the impact of a CVS onto another. In short, the proposed analysis of the alignment between CVSs considers the following parameters:

- the shared core values between CVSs;
- the positive impacts between core values of the two CVSs;
- the negative impacts between core values of the two CVSs;

and is performed at two different levels:

- the CVSs alignment among network members;
- the CVSs alignment between the network and the network members.

5.2. A qualitative approach

Starting from the work on cognitive maps by Eden (1992a), and the work on qualitative operators for reasoning maps by Montibeller and Belton (2009), a qualitative inference approach is proposed

in order to assess the level of shared values, the potential for conflicts among network members, and the positive impacts between CVSs. In a first step, only the direct influence among core values is considered; however, as the propagation of influences in core values maps can have some relevance in the assessment, an extension to this method will be proposed later on.

In our model, the priorities of core values and the strength of influences are qualitatively specified, and are taken into account in the definition of the three alignment criteria, as follows:

- **Shared core values** – If shared core values have a very high priority to the considered entities, then the alignment level is very high. In the case that shared core values have just a fair priority, then the alignment level is lower. Let us take, for example, the case of the CVS represented in Fig. 2. The *profit* core value is shared by the three organizations. However, since *profit* has a very high degree of importance for the Research Center, and just a fair degree of importance for University A, then it is considered that the level of shared values with CN_1 is higher in the case of the Research Center than in the case of University A.
- **Positive impact** – The stronger the positive influence between two core values is, higher is the positive impact. The higher the degree of importance of the positively influenced core value, the higher is the positive impact. For example, in the case illustrated in Fig. 2 as *uniqueness* has a weak influence on *profit*, concerning this influence, it is considered that the positive impact of the Researcher Center in CN_1 is low. On the other hand, as *knowledge* has a strong positive influence on the *innovation* core value, it is considered that the positive impact of University A on CN_1 is high.
- **Potential for conflict** – The stronger the negative influence among two core values is, the higher is the potential for conflict. The higher the degree of importance of the negatively influenced core value, the higher is the potential for conflict. In the considered example, as *standardization* has a strong negative influence on *uniqueness*, thus it is considered that there is a high potential for conflict between Factory A and Research Center.

The formal specification of how each alignment criteria can be calculated is presented in Table 3. These definitions assume the formal specification of the maps belonging to V-AligN framework presented in Table 2.

The proposed qualitative inference process uses decision tables as a mechanism to specify how the qualitative values are aggregated. Thus, two decision tables have to be specified in order to: (i) calculate the intensity of the shared core-values according to each core-value priority, (ii) calculate the intensity of the positive impact and the intensity of the potential for conflict, according to the intensity of the influence relationship and the degree of importance of the core-values. These decisions tables can implement straightforwardly the way of thinking of experts, allowing also a simple customization and/or optimization.

An example of possible decision tables for calculating the intensity of the shared-value, of the potential for conflict and of the positive impact is presented in Fig. 3.

5.3. Inferred influences in CVSs alignment analysis

The proposed assessment method assumed that only direct influences between core values are considered. In fact, by considering the example previously introduced and by observing the causal map of Fig. 2, we can notice that *standardization* influences *quality* positively in a direct way. However, as on one hand *standardization* influences *quality*, and *quality* influences *profit*, and on the other hand *standardization* influences *uniqueness*, and *uniqueness* influences *profit*, we can also deduce that *standardization* somehow influences *profit* in an indirect way. Thus, it is reasonable to define two kinds of influence relationships: the direct influence and the indirect influence. In the case we have more than one influence path from one core value to another, the total influence level should be inferred.

To infer the total influence relationship between two core values, the following operations have to be performed (see Fig. 4): (i) Determine all partial influences, both direct influences and indirect influences; (ii) Determine the result of joining all indirect influences, calculated in (i); and (iii) Determine the result of the composition of all partial influences (direct and indirect).

In order to characterize each inferred influence relationship, it is necessary to specify how the intensity and sign of partial influences and total influences can be inferred. One possible solution considered is to apply the Fuzzy Operators suggested by Kosko (1986), namely the *minimum* operator and the *maximum* operator. The *minimum* operator reflects a pessimist approach, while the *maximum* operator reflects an optimist approach. Both operators can reflect a partial-effect, nevertheless this leads to a degradation of outcomes by compressing or enlarging the intensity of the influence effect (for example, for the *minimum* operator, the outcome of *min* (*moderate*, *weak*) is equal to *min* (*strong*, *weak*)). In the case of inferring the total effect, an operator that implements the notion of aggregation of influences is required; however, the *minimum* and *maximum* operators are non-aggregative, only reflecting a partial effect. On the other hand, decision-tables are an easier way to elicit preferences of decision makers, and the partial and the total influence effects can be fully specified by the user (Montibeller & Belton, 2009). Thus, similar to what was done for the qualitative indicators presented above, decision tables (*decT*3, *decT*4, *and decT*5) have to be specified in order to infer the resulted intensity and sign of the inferred influences. In Table 4 the calculations required to implement the inference process are formalized. After the indirect influences between core values be inferred, the CVSs

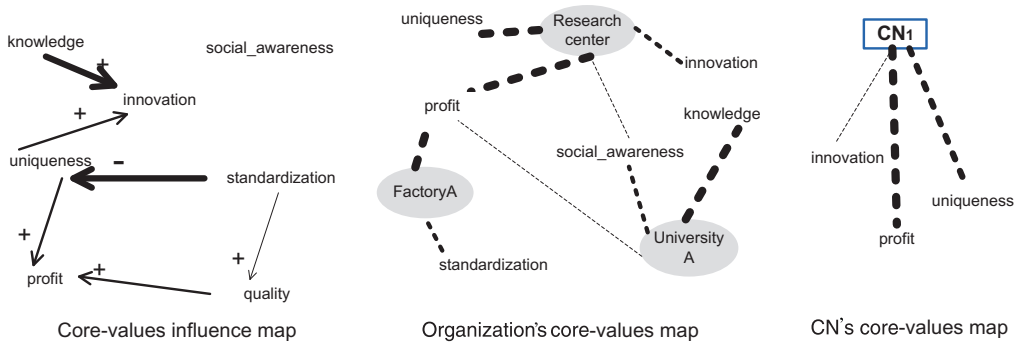


Fig. 2. Examples of modeling CVS in collaborative environment using V-AligN framework.

Table 3
CVSs alignment indicators: formal specification.

Description	Formal specification
Shared values level (SH) There is a shared core value between two Core Value Systems, CVS_x and CVS_y, if there is a core value cv_i that belongs to both Core Values Systems. SH_{xy} represents the set of shared core values between CVS_x and CVS_y associated with the respective degrees of importance. $SharedValues_{xy}$ is the set of shared core values between CVS_x and CVS_y and the corresponding inferred intensity	• $SH_{xy} = \{(cv_i, di_x, di_y)$: $(\exists ew_{xi} = (cv_i, ent_x, di_x) \in EW) \wedge (\exists ew_{yi} = (cv_i, ent_y, di_y) \in EW)\}$, where, $EW = \{ew_{xi} = (cv_i, ent_x, di_x)$: $cv \in CV \wedge ent_x \in (CN \cup O) \wedge di_x \in DI\}$ • $SharedValues_{xy} = \{(cv_i, dti_{xy})$: $\exists sh_{xy} \in SH_{xy} \wedge cv_i = coreValue(sh_{xy}) \wedge dti_{xy} = sharedValueIntensity(sh_{xy})\}$ • $sharedValueIntensity$: $SH_{xy} \rightarrow DI$ • $sharedValueIntensity(cv_i, di_x, di_y) = decT1(di_x, di_y)$ • DI is the partial order set for the degrees of importance • decT1: DI × DI → DI is a decision table for aggregating two qualitative values related to the degree of importance of the shared core-value
Positive impact level (PI) There is a positive impact between CVS_x and CVS_y, if there is a core value cv_i that belongs to CVS_x and a core value cv_j that belongs to CVS_y, so that cv_i influences cv_j positively. PI_{xy} defines the set of positive impacts of CVS_x on CVS_y. $PositiveImpacts_{xy}$ is the set of positive impacts of CVS_x on CVS_y, and the corresponding inferred intensity for each positive impact	• $PI_{xy} = \{e_{ij} = (cv_i, cv_j, p, s) \in E$: $s = 1 \wedge cv_i \in CVS_x \wedge cv_j \in CVS_y\}$ • $PositiveImpacts_{xy} = (cv_i, cv_j, dt_i)$: $\exists e_{ij} = (cv_i, cv_j, p, s) \in PI_{xy} \wedge \exists ew_{yj} = (cv_j, ent_y, p) \in EW \wedge dt_i = impactIntensity(e_{ij}, ew_{yj})\}$, where: • $EW = \{ew_{xi} = (cv_i, ent_x, di_x)$: $cv \in CV \wedge ent_x \in (CN \cup O) \wedge (di_x \in DI)\}$ • $impactIntensity$: $PI \times EW \rightarrow P$, $impactIntensity(e_{ij}, ew_{yj}) = decT2(intensity(e_{ij}), preference(ew_{yj}))$ • $decT2$: $P \times DI \rightarrow P$ is a decision table for aggregating two qualitative values related to the strength of the influence between core-values and the degree of importance of the influenced core-value • P is the partial order set of the possible values for the strength of the influence between two core values • DI is the partial order set of the possible values for the degrees of importance
Potential for conflict level (CI) A potential for conflict between CVS_x and CVS_y exists if there is a core value cv_i that belongs to CVS_x and a core value cv_j that belongs to a CVS_y, so that cv_i influences cv_j negatively, or cv_j influences cv_i negatively. CI_{xy} defines the set of conflicts between CVS_x and CVS_y $PotentialforConflict_{xy}$ is the set of potential for conflicts between CVS_x and CVS_y, and the respective inferred conflict intensity	• $CI_{xy} = \{e_{ij} = (cv_i, cv_j, p, s) \in E$: $s = -1 \wedge cv_i \in CVS_x \wedge cv_j \in CVS_y\} \cup \{e_{ij} = (cv_j, cv_i, p, s)$: $s = -1 \wedge cv_j \in CVS_y \wedge cv_i \in CVS_x\}$ • $PotentialforConflict_{xy} = \{(cv_i, cv_j, dt_i)$: $\exists e_{ij} = (cv_i, cv_j, p, s) \in CI_{xy} \wedge \exists ew_{yj} = (ent_y, cv_j, p) \in EW \wedge dti = conflictIntensity(e_{ij}, ew_{yj})\}$, where • $EW = \{ew_{xi} = (cv_i, ent_x, di_x)$: $cv \in CV \wedge ent_x \in (CN \cup O) \wedge (di_x \in DI)\}$ • $conflictIntensity$: $CI \times EW \rightarrow P$ • $conflictIntensity(e_{ij}, ew_{yj}) = decT2(intensity(eij), preference(ew_{yj}))$ • $decT2$: $P \times DI \rightarrow P$ is a decision table for aggregating two qualitative labels related to the strength of the influence between core-values and the degree of importance of the influenced core-value • P is the partial order set of the possible values for the strength of the influence between two core values • DI is the partial order set of the possible values for the degrees of importance

decT1 (p1,p2)	***zero***	***low***	***moderate***	***high***
zero	zero	zero	zero	zero
low	zero	zero	low	low
moderate	zero	low	moderate	moderate
high	zero	low	moderate	high

decT2 (p,ew)	***low***	***moderate***	***high***
low	low	low	moderate
moderate	low	moderate	high
high	low	moderate	high

Fig. 3. An example of decision tables (*decT*1 and *decT*2).

alignment indicators are calculated in accordance with the expressions previously specified in Table 3, in the same way as just considering direct influences.

In order to illustrate how the alignment level can be determined using the inferred influence formulas specified above (see Tables 3 and 4) a small example is presented in Table 5. This example shows the calculation of the Shared Value Level and the Potential for Conflict Level between Factory A and the Research Center of the example shown in Fig. 2, where the decision tables represented in Fig. 5 were applied. In real contexts, due to the complexity of the inference process, calculations are done using a computational tool as it will be explained further.

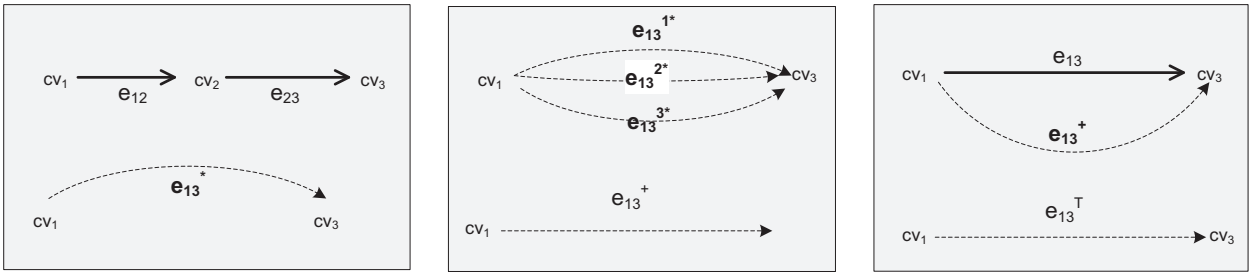
6. Application example

6.1. Introduction to the case study

In order to illustrate the practical relevance of the proposed model a case study is analyzed. This case was observed inside the ECOLEAD project, which was a large integrated project funded under the 6th Framework Program of the European Commission, and which aimed at creating the foundations and mechanisms for establishing an advanced collaborative and networked-based industry society in Europe (Camarinha-Matos & Afsarmanesh, 2005). The project was a 4-year initiative involving 28 partners, academic and industry, from 14 countries across Europe and Latin America.

The data used for assessing this case is based on questionnaires filled in by the partners. For a question of privacy, the partners are not identified. For this example, the following assumptions are made:

- The ECOLEAD project is considered to be a CN, where partners (universities, industries, and research institutes) have adhered to a medium term cooperation agreement of 4 years with the main goal of achieving the research objectives of the project.
- The ECOLEAD project is divided into several work packages. Each work package team is considered as being a collaborative network of short term, like a virtual organization (VO), created to respond to a specific set of objectives.



(1) Partial influences: indirect and direct influences

(2) Joint indirect influence

(3) Total influence

Fig. 4. Inference operations.

Table 4
Inferred influences: formal specification.

Description	Specification
Direct influence There is a direct influence (e_{ij}) of core value cv_i on core value cv_j, if in the core values influence map (CIVM) (see Table 2) there is a direct path (link) from the node cv_i to the node cv_j	$\exists e_{ij} \in E$:*CVIM* = (*CV*, *E*)
Indirect influence There is an indirect influence of cv_i on cv_j if there is a core value cv_k, such that there is a direct influence (e_{ik}) between cv_i and cv_k; and there is a path (e^*_{kj}) between the node cv_k and cv_j *iValue* ($e^{n^*}_{ij}$) denotes the intensity and sign of the *n*-path indirect influence of core value cv_i on cv_j	• *iValue*: $E^* \to (P_0, S)$ $iValue(e^{n^*}_{ij}) = (iIntensity(e^{n*}_{ij}), iSignal(e^{n*}_{ij}))$ • *iIntensity*: $E^* \to P_0$ $iIntensity(e^{n^*}_{ij}) = decT3(intensity(e_{ik}), intensity(iIntensity(e^{n*}_{kj}))$ • *iSign*: $E^* \to S$ $iSign(e^{n^*}_{ij}) = sign(e_{ik}) \times sign(iSign(e^{n*}_{kj}))P_0$={zero, weak, moderate, strong}, is the partial ordered set where the label zero means null influence*decT3*:$P_o \times P_o \to P_0$, specifies a decision table
Joint indirect influence The joint indirect influence of cv_i on cv_j results from combining all indirect influences of core value cv_i on core value cv_j *jointIValue*($e^{n^+}_{ij}$) denotes the intensity and sign of the aggregation of the *n*-first indirect influences of core value cv_i on core value cv_j. If there is only one indirect path from cv_i to cv_j, the joint influence is reduced to the indirect influence	• *jointIValue*:$E^+ \to (P_0, S)$ – [there is just one path between cv_i and cv_j] $jointIValue(e^{1+}_{ij}) = iValue(e^{1^*}_{ij})$ – [there is more than one path between *cvi* and *cvj*] $jointIValue(e^{n+}_{ij}) = decT4((iValue(e^{n^*}_{ij}), jointIValue(e^{(n-1)+}_{ij}))decT4$: $(P_0, S) \times (P_0, S) \to (P_0, S)$ specifies a decision table
Total influence The total influence of cv_i on cv_j results from the combination of indirect influences and the direct influence of core value cv_i on cv_j. Hence, if there is only a direct influence from cv_i to cv_j, the total influence is reduced to the direct influence If there is only one indirect path from cv_i to cv_j, the joint influence is reduced to the indirect influence *totallValue*(e^T_{ij}) denotes the intensity and sign of the total influence effect of core value cv_i on core value cv_j	*totallValue*: $E^T \to (P0, S)$ • there is just a direct path between cv_i and cv_j $totallValue(e_{ij}) = influenceValue(e_{ij})$ • there is just indirect paths between cv_i and cv_j $totallValue(e^+_{ij}) = jointIValue(e^+_{ij})$ • there is just indirect paths between cv_i and cv_j $totallValue(e^T_{ij}) = decT5(jointIValue(e^T_{ij}), influenceValue(e_{ij}))decT5$: $(P_0, S) \times (P_0, S) \to (P_0, S)$ specifies a decision table

decT3(p1,p2)	zero	low	moderate	high
zero	zero	zero	zero	zero
low	zero	zero	low	low
moderate	zero	low	moderate	moderate
high	zero	low	moderate	high

decT4(p,s)	(high,-1)	(moderate,-1)	(low,-1)	(zero,0)	(low,+1)	(moderate,+1)	(high,+1)
(high,-1)	(high,-1)	(high,-1)	(high,-1)	(high,-1)	(moderate,-1)	(low,-1)	(zero,0)
(moderate,-1)	(high,-1)	(high,-1)	(high,-1)	(moderate,-1)	(low,-1)	(zero,0)	(low,+1)
(low,-1)	(high,-1)	(high,-1)	(moderate,-1)	(low,-1)	(zero,0)	(low,+1)	(moderate,+1)
(zero,0)	(high,-1)	(moderate,-1)	(low,-1)	(zero,0)	(low,+1)	(moderate,+1)	(high,+1)
(low,+1)	(moderate,-1)	(low,-1)	(zero,0)	(low,+1)	(moderate,+1)	(high,+1)	(high,+1)
(moderate,+1)	(low,-1)	(zero,0)	(low,+1)	(moderate,+1)	(high,+1)	(high,+1)	(high,+1)
(high,+1)	(zero,0)	(low,+1)	(moderate,+1)	(high,+1)	(high,+1)	(high,+1)	(high,+1)

Fig. 5. Example of decision tables (*decT3* and *decT4*).

An example of such a temporary network (VO) inside ECOLEAD was the group in charge of the development of the VO Creation Framework (VOCF) prototype. This prototype (Camarinha-Matos et al., 2008) integrates a set of services that support the VO creation process, namely: Collaboration Opportunities Identification, Collaboration Opportunities Characterization and Rough Planning, Partners Search and Suggestion, and Contract Negotiation. The objectives of this work package intended to be achieved through collaborative research work among eight distinct organizations belonging to the ECOLEAD consortium. The CVSs data are

Table 5
Application example.

Example: determine CVS alignment level between Factory A and Research Center
Shared values $SharedValues_{FaRc} = \{(profit, d_{profit\ FaRc})\}$ $d\_profit_{FaRc} = sharedValueIntensity(profit, dt\_profit_{Fa}, d\_profit_{Rc}) = decT1(d_{tprofit_Fa}, dt_{profit_Rc}) = decT1(high, high) = high$
Potential for conflict In order to determine the potential for conflict between Fa and RC, first, all core-values that belongs to CVSFa that have negative influence of core-values of CVSRc (and vice versa) has to be determine • Identify the values that belongs to each CVS: $\{profit, standardization\} \in CVS_{Fa}$, $\{uniqueness, innovation, profit\} \in CVS_{Rc}$ • For each pair (cv_i, cv_j) with $cv_i \in \{profit, standardization\}$, $cv_j \in \{uniqueness, innovation, profit\}$ 1. Determine direct influences $e_{ij} = (cv_i, cv_j, p, s)$ $cv_{i1} = standardization$, $cv_{j1} = uniqueness$: $e_{i1j1} = (cv_{i1}, cv_{j1}, high, -)$ 2. Determine indirect influences $e^*_{ij} = (cv_{i2}, cv_{j2}, p, s)$ $cv_i = standardization$, $cv_j = innovation$ $e^*_{i2j2} = (cv_{i2}, cv_{j2}, decT4((high, -), (moderate, +))) = (cv_{i2}, cv_{j2}, low, -)$ 3. Determine total influences $e^*_{ij} = (cv_i, cv_j, p, s)$ For $cv_{i1} = standardization$, $cv_{j2} = uniqueness$: $e^T_{ij1} = e_{ij} = (cv_{i1}, cv_{j1}, high, -)$ For $cv_{i2} = standardization$, $cv_{j2} = innovation$: $e^T_{ij2} = (cv_{i2}, cv_{j2}, low, -)$
$PotentialforConflict_{Fa,Rc} = \{(standardization, uniqueness, dt_{i1})(standardization, innovation, dt_{i2})\}$, *such as* $dt_{i1} = conflictIntensity(e^T_{ij1}, ew_{Rcj1}) = decT2(intensity(e^T_{ij1}), preference(ew_{RCj1})) = decT2(high, moderate) = moderate$ $dt_{i2} = conflictIntensity(e^T_{ij2}, ew_{Rcj2}) = decT2(intensity(e^T_{ij2}), preference(ew_{RCj2})) = decT2(low, moderate) = low$

Table 6
Core values and their degree of importance for each entity.

Entity	Core values and degree of importance
O1	Innovation very-high; interdisciplinary fair; knowledge very-high; reputation high; quality very-high; sharing high
O2	Innovation very-high; knowledge very-high; reputation fair; quality high; reliability high, sharing high
O3	Agility fair; financial stability high; profit very-high; quality very high; standardization very-high
O4	Innovation high; profit high; quality high; reliability very-high; responsiveness very high
O5	Financial stability very-high; innovation high; profit high; reliability high; responsiveness high
O6	Employee satisfaction very-high; equitity high; innovation high; interdisciplinary high; knowledge high; reputation high
O7	Interdisciplinary fair, knowledge high; self-interest high; uniqueness high
O8	Innovation very high; profit high; reputation very-high, responsiveness very-high
VOCF group	Agility very-high; innovation high; profit fair; reliability high; responsiveness very-high, sharing high

presented in Table 6, where the core values and priorities were provided by the participants of the work package. The core values were selected from a pre-defined list of 21 core values.

In order to be able to discuss the potential advantages of using the proposed method for values alignment assessment in collaborative contexts, two distinct approaches were followed:

(1) V-AligN based approach, a qualitative alignment assessment, which comprises three indicators: *shared values level*, *positive impact level*, *potential for conflict level*.
(2) A traditional approach where just one alignment indicator is used: the *percentage of core-values shared*.

6.2. Approach 1: V-AligN based approach

To make the CVSs alignment assessment approach proposed in previous section a web-based tool was developed in J2EE platform to support the CVS management in collaborative environments. This tool supports the qualitative methods to access CVSs alignment within the scope of V-AligN framework at two levels: (i) assessment of CVSs alignment between the group and each group member; (ii) assessment of CVSs alignment among group members. The qualitative inference methods were implemented using a Prolog rule engine and accessed using the jpl-API as illustrated in Fig. 6.

The CVSs alignment assessment assumes the existence of a catalog of possible core values and the definition of the influence relationships between pairs of core values. Such knowledge can be directly provided by experts or result from surveys and interviews (see as examples Collins & Porras, 1996; Rekom, Riel, & Wierenga, 2006). For this case study, the core values influence map that was considered is shown in Fig. 7.

The assessment process follows the execution of the next steps:

- **Step 1:** The network manager configures the network, specifying its members.
- **Step 2:** Each network member defines its preferences (main core values and the degree of importance of each one), and the network manager or network planner defines the network CVS. The visualization of the CVS maps is required for the respective network (see in Fig. 8 the map generated by the CVS analysis Tool for the *VOCF group*), in order to obtain an overview of the configured CVSs for each member.
- **Step 3:** The assessment of CVSs alignment is performed. A set of qualitative indicators is provided for the two levels of alignment: (i) network level; (ii) member level (see an example for the network level in Fig. 9).

The results of the assessment of CVSs (considering direct and indirect influences) for the VOCF group are presented in Table 7, where it can be noticed that all members have a significant *positive impact* on the group. Moreover, except for the O7 member, all the others present a high level of shared core values with the group's CVS. The analysis of the *potential for conflicts* among the VOCF group members shows that there is no *potential for conflict* between O1 and O2, O4, O5, O6 and O8, and also between O6 and O1, O2, O4 and O8. This suggests that O1 and O6 are members that represent a low risk in terms of *potential for conflicts* with their partners. On the other hand, O7 is the member that has a higher potential for conflict with the other group members, since the level

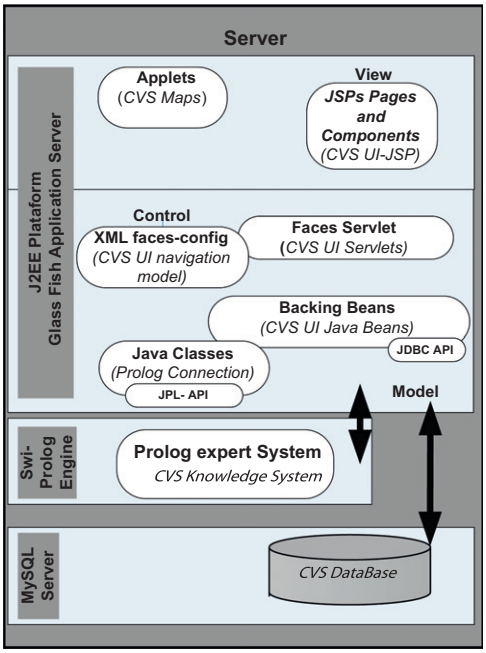


Fig. 6. Overview of the architecture of the developed assessment tool.

of *potential for conflict* with O6 and O8 is high, and only with O4 and O5 a low level of *potential for conflict* was obtained. Additionally, O7 is also the organization that in global terms has the lowest level of *shared core values* with its partners, and that has the low *positive impact* on the group's CVS. This suggests that O7 is the organization that has the weakest alignment level with the group in terms of core values.

Another interesting aspect to note is the fact that although O4 and O7 do not share any core value, still their *potential for conflict* is low. This suggests that these two partners are quite indifferent towards each other in terms of CVS. The same happens between O5 and O7. The pairs of organizations (O1, O2), (O1, O6), (O2, O6) have a high level of *shared core values*, what means that the CVSs of O1, O2 and O6 are quite similar. The organizations O4 and O5 have also a high level of *shared core values*, but their level of *potential for conflict* is moderate. This means that in spite of the similarity between the two CVSs, they have core values that are not fully compatible.

Comparing the alignment assessment results with the feedback obtained from ECOLEAD managers, we can conclude that the indications provide by the proposed assessment model are in accordance with the opinion of the participants in this collaborative process. The ECOLEAD project managers are of the opinion that O7 was the most unaligned participant regarding the group's CVS, contributing negatively to the specific collaborative process. From the results presented above, we may observe that O7 is the organization that has the lowest alignment level with the group and presents a high potential for conflict with several members. Furthermore, the results obtained about O3, suggest that this organization also presents some risks to the network in terms of potential for conflicts, nevertheless the project managers did not detect any kind of problem with the O3's behavior. Such small discrepancies between the results obtained from the CVSs alignment assessment and the opinion of the project managers may have diverse causes, such as:

(i) The specification of the CVS for each member derives from data provided by the participants in the project. Therefore, the resulted CVS reflects the CVS observed by the other participants, and not exactly the actual partner's CVS. If a more structured method (like the ones suggested in Barrett (2006), Rekom et al. (2006), or Collins and Porras (1996)) is used for the identification of core values and preferences of each organization, a more accurate CVS can be obtained, and consequently, more precise outputs from the alignment assessment can be achieved.

(ii) The core values influence map has a decisive importance in the obtained results. Therefore more work needs to be done in order to increase the correctness of the proposed map.

(iii) In the case that collaboration is based on the development of a project, the role of individuals is significantly important, overriding the importance of the organization's role. Thus, in these cases the degree of success and sustainability of the collaboration depends, essentially, on the attitudes and behaviors of the individuals that work directly in the project. Therefore, the CVS modeled should represent the CVS of the individuals and not the institutional CVS of each organiza-

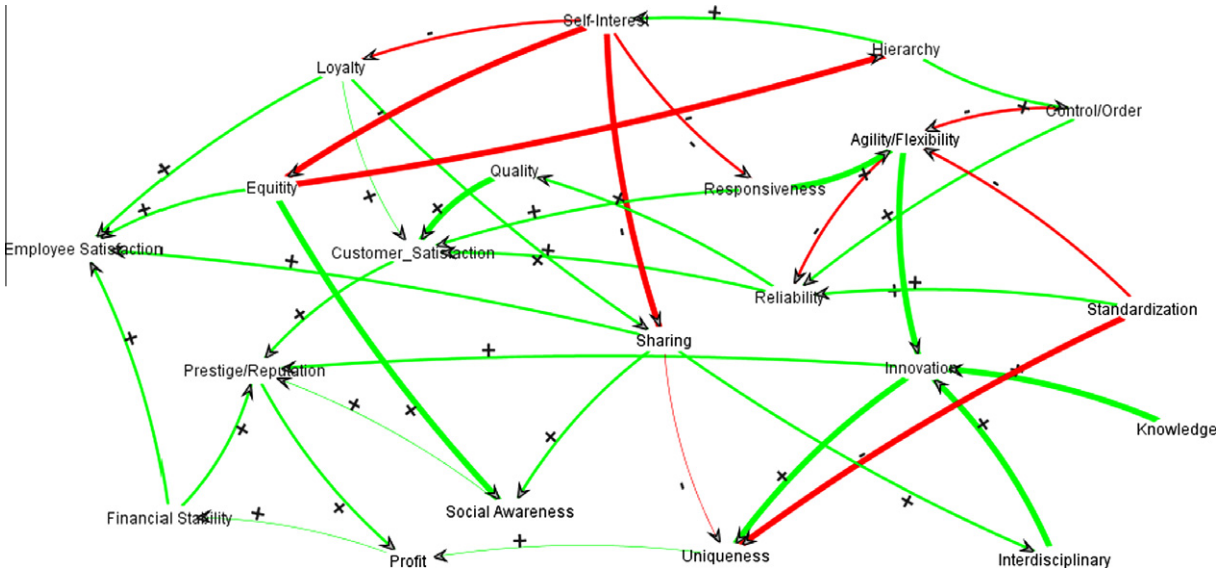


Fig. 7. Core values influence map for the case study.

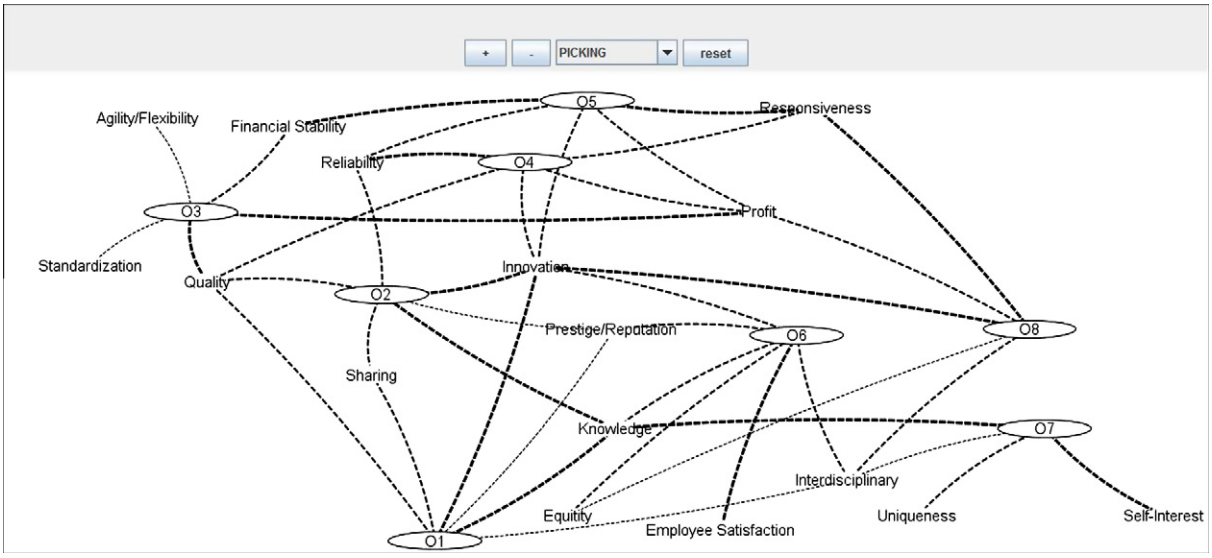


Fig. 8. CVS map for group members in the case study.

Fig. 9. Usage of the value system analysis component.

tion, since in less formal collaborations types; the CVS of each organization does not reflect the behavior of its members. This aspect is also in accordance with the feeling of the project manager.

6.3. Approach 2: Traditional approach

The traditional approach was applied to the same set of data, where the percentages of shared values between each pair of group members and between the collaborative network and each member were computed. The results obtained are presented in Table 8.

According to the results obtained for the percentage of shared values it is considered that O4 and O5 are aligned with the CVS of VOFC group in terms of values. Moreover, it can be observed that O6 and O7 have a very low level of values alignment with VOFC group. In terms of member level assessment the results suggest that O1 represents some risk to the group, since low values of alignment are obtained with O3, O5, and O7. O3 member represents a high risk to the group, since low values of alignment were obtained with O1, O5, O6, O7, and O8. However, O7 is the member that is more misaligned, with the other partners, since it does not share any value with O3, O4, O5 and O8, and it has a low level of values shared with all the other partners. On the other hand, the pairs (O1, O2), (O1, O6) and (O4, O5) are the ones that have a higher alignment level, since they share a high percentage of their core values.

Comparing the alignment assessment results with the feedback obtained from ECOLEAD managers, we can conclude that the indications provide by this assessment model are not in accordance, on several aspects with the opinion of the participants in this collaborative process. The results obtained about O1 and O3, suggest that O1 and O3 present some risks to the network in terms of potential for conflicts; nevertheless the project managers did not detect any kind of problem with the O3's or O1's behavior. Additionally

Table 7
Example of CVSs alignment assessment results using the V-AligN approach.

			Member							
			O1	O2	O3	O4	O5	O6	O7	O8
Network Level	Positive impact		HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	MODERATE	HIGH
	Shared core values		MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	LOW	MODERATE
Member level	Potential for conflict	Members O1		NotDetected	MODERATE	NotDetected	NotDetected	NotDetected	MODERATE	NotDetected
	Shared			HIGH	LOW	MODERATE	LOW	HIGH	MODERATE	MODERATE
	Potential for conflict	O2			MODERATE	LOW	LOW	NotDetected	MODERATE	LOW
	Shared				LOW	MODERATE	MODERATE	HIGH	LOW	LOW
	Potential for conflict	O3				MODERATE	LOW	MODERATE	MODERATE	LOW
	Shared					MODERATE	MODERATE	NotDetected	NotDetected	LOW
	Potential for conflict	O4					MODERATE	NotDetected	LOW	LOW
	Shared						HIGH	LOW	NotDetected	MODERATE
	Potential for conflict	O5						NotDetected	LOW	LOW
	Shared							LOW	NotDetected	MODERATE
	Potential for conflict	O6							HIGH	NotDetected
	Shared								MODERATE	MODERATE
	Potential for conflict	O7								HIGH
	Shared									LOW

Table 8
CVSs alignment assessment results according to shared values.

		Members							
		O1	O2	O3	O4	O5	O6	O7	O8
Network Level	%Shared values	33%	50%	40%	80%	80%	17%	0%	67%
Member Level	%Shared values	O1	83%	20%	40%	20%	80%	25%	50%
	%Shared values	O2		20%	60%	40%	60%	50%	50%
	%Shared values	O3			40%	20%	0%	0%	25%
	%Shared values	O4				80%	20%	0%	75%
	%Shared values	O5					20%	0%	75%
	%Shared values	O6						25%	50%
	%Shared values	O7							0%

according to these results it seems that just O4 and O5 CVSs fit the VOFC's CVS, however in accordance with the VOFC manager, except O7, all the others members contributed positively to the success of the project.

6.4. Comparing the two approaches

Comparing the results of the two assessment approaches, we conclude that the V-AligN approach can provide more accurate information about the CVS's alignment in collaborative contexts. As the traditional approach, just evaluates the percentage of shared values, we cannot identify which partners have a positive impact on VOFC's CVS. For example, following the traditional approach we have found that O1 and O6 are misaligned with VOFC, however following the V-AligN approach we have been able to conclude that O6 has a high positive impact level, in spite of having just a moderate level of shared values with VOFC group, and O1 has also a high positive impact level with VOFC. Another aspect where the traditional approach fails is in detecting negative impacts between CVSs. For example in case of O4 and O5 members, in spite of having a great percentage of shared values, they have a moderate potential for conflict, since there is an indirect negative influence between its CVSs.

These results evidence that the proposed approach proposed brings new information to decision-makers about values alignment. This new approach allows that two common mistakes were avoid: (i) rejecting potential partners that present a low percentage of shared values, when in fact their core values may have a high positive impact in the CVS of the network; (ii) Assuming that a pair of members will work well together, just because they share some of their core values, while in fact they have incompatible values (the core value $cv1$ is considered to be incompatible with the core value $cv2$ if $cv1$ has a negative influence on $cv2$ or vice versa).

7. Conclusions

As collaborative networks constitute an important organizational structure to promote innovation, namely in the context of small and medium size enterprises, it is vital to be able to detect as early as possible, the potential for conflicts among network members. For this purpose, the idea of using a qualitative approach, based on fuzzy causal maps and graphs, to develop qualitative indicators to assess Core Value Systems alignment in collaborative environments was introduced. This research aimed also to contribute to technological innovation in the way that it provides new methods and tools to support Collaborative Networks management in the scope of Value Systems management and analysis. The presented qualitative approach contributes with a new way to analyze values alignment, through the application of qualitative causal reasoning to infer qualitative indicators about Core Value Systems alignment in a collaborative context. This approach has the following main advantages: (i) it facilitates the representation of knowledge about core values; (ii) it promotes more "transparency" and understandability of the reasoning mechanisms since decision tables are expressed in qualitative terms; and (iii) it makes easier the interpretation of the outputs for all agents of the decision making process, because outputs are expressed totally in qualitative terms.

The case study presented showed how the qualitative alignment assessment can be applied in practice. Although the performance of the proposed methods as evidenced by the achieved results is quite satisfactory in comparison with the traditional approach (using just the percentage of shared values as indicator of alignment), it is necessary to do a more extensive experimental validation, involving more case studies and also the feedback of domain experts (managers and sociologists) about the obtained indicators.

The positive impact indicator allows identifying the core values that contribute positively to the performance of an organization, thus it can be used as a "tool" to identify the factors that represent indeed an incentive to the organization. Therefore, the use of the proposed assessment method in order to improve the management of an incentive policy in the scope of Collaborative Networks appears as an application area to explore further.

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