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A rational approach to identify and cluster intangible assets: A relational perspective of the strategic capital

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A rational approach to identify and cluster intangible assets

Perspective of
the strategic
capital

A relational perspective of the strategic capital

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Abstract

Purpose – This study is intended to work out a bottleneck in the comprehension of the relational nexus which links the set of key strategic resources (SRs) of a company, represented by the uncertain recognition and the ambiguous clustering of their intangible components. The purpose of this paper is to provide a candidate solution for a rational appraisal of the inventory of the knowledge-based resources held by a company, which synergically form its Intellectual Capital (IC).

Design/methodology/approach – This goal is achieved by the means of a qualitative/quantitative approach composed of sequential phases, intended to: atomize the value domain of the firm into its basic building blocks; gauge their mutual interactions and impacts; re-aggregate those involved entities accordingly; cluster them into a collection of identified and validated Intangible Assets (IAs). Never giving any direct judgment on the IAs themselves (whose extension can be fuzzy or unknown). But on the impacts between the value drivers they are built on.

Findings – The proposed procedure, step-by-step illustrated by means of a numerical simulation, out of the amorphous mass of the SRs, returns an analytic picture of its composing elements keeping track of their intertwined connections and mutual influence. Consequently, allowing the comprehension of the actual framing and of the relational positioning and magnitude of such entities.

Practical implications – This risk-mitigated rational identification of IAs allows the analyst to target a proper evaluation technique on them. And the management of the company to mindfully allocate/leverage on them to improve business performance and strategy alignment. The implementation returns some analytic tools which render a diagnostic snapshot of the composing elements of the IC, increasing the awareness of such entities and allowing internal/external benchmarking.

Originality/value – The suggested methodology mitigates the risk of discretionality in the definition of the perimeter of each target-entity, by avoiding any direct biased judgment on them. So that each asset gets unambiguously identified within a network-logic and the interlinked portfolio of knowledge-based resources can be assessed and managed in a rational and traceable way.

Keywords Clustering, Intellectual capital, Business valuation, Intangible assets portfolio, Relational benchmarking, Strategic capital

Paper type Research paper



1. Introduction

Every company in the world is characterized by a unique blend of resources and, at the same time, by the peculiar way it exploits them as a whole. Indeed, through their proper allocation, deployment and management, each company achieves its business goals in alignment with the traced strategy so that they are actually utilized as the key to create

value and gain competitive advantage. Such entwined collections of strategic resources (SRs), once put in use, represent a proxy of companies' distinctiveness, as highlighted by the resource-based view (RBV) (Penrose, 1959; Wernerfelt, 1984). Furthermore, the knowledge-based view (KBV) (Grant, 1996) considered critical for competitiveness a sub-set of SRs, characterized by knowledge-nature and knowledge-processes. From a resource standpoint, the KBV identified the Intangible Assets (IAs) as the main "knowledge-based" source of value creation and performance. It is due to the intrinsic value of the knowledge substratum that they embody and vehicle throughout the value system of the organization, that such resources can play a starring role among the SRs for gaining competitive advantage (Itami, 1987; Roos *et al.*, 1997).

Nevertheless, it is also true that each set – each blend – of resources physiologically comes with different mutual relations among its components. And different implications about the way each company creates value through them (Starovic and Marr, 2003). Therefore, their proper appraisal is a critical – crucial, actually – point for their subsequent successful management, since it should be capable of appreciating their interlinked relations.

And, what is more, the issues around any consistent valuation of IAs find their origin in a previous logic step: in their propaedeutic identification – that should be unambiguous and rational – and in their proper framing within the very fabric of the organization. When it comes to their assessment, a great benefit could be represented by the fact of avoiding the use of "preset definitions" for each target IA. This is because, regardless of their possible comparable names, they could represent something even extremely different among each company in which they are nurtured. The multiplicity of interrelations among them and the role they play (in concert with all the other key-resources), for a specific company operating in a specific business, make a sensible difference in defining their essence. Therefore, if any auditing/assessment process of the IAs starts with such out-of-focus assumptions deriving from the use of generic definitions, it is quite subsequent that the entire appraisal will be jeopardized. The risk is to obtain biased and distorted findings, caused by overlaps/mismatches, under/over esteems, redundancies/omissions. Therefore not because of the choice of an inappropriate evaluation technique, but simply because of an inaccurate targeting of the entities to be assessed, upstream (Brugger, 1989; Collis, 1994).

Traditional approaches that can be found both in literature and in practice appreciate the IAs always considering them as "previously defined" constructs, using logic categories which are formed and labeled before the assessment-process itself. Therefore using some "ex machina" criterion, detached from any real-case specificity. Furthermore, they hardly factor adequately the knowledge dynamics which first originated and now link them (Estivill-Castro, 2002; Choong, 2008; Ferenhof *et al.*, 2015). This could provoke a major chain-effect error: when starting a new assessment, the analyst just takes the intangible entity to be estimated for granted, never questioning about its real nature and the mutual relations it builds with other intangibles. The common use of preset categories reflects a common top-down wise thinking, but which just leads to a common risk: if there is any mis-recognition error on the entities to be studied at the very beginning of the analysis, this will be inherited to the conclusions and unavoidably affect them.

Would not it be worthier using an unbiased identification solution for such resources in the first place? A qualitative/quantitative one, that allows even the tracking of their clustering, in order to secure, at least, from the risk deriving from the use of preset categorizations. Furthermore, a reliable candidate solution should be also built around some less fuzzy criteria, than outlining the shape of such intangible aggregates from

scratch, in a discretionary way. A more rational and pragmatic view could come from considering their connection with the value system they belong to and the relational links among their knowledge-based constituents.

The purpose of this paper is to provide an answer to the above critical points related to IA identification and categorization: a propaedeutic logic-step to any attempt of assessment and evaluation. The novel contribution of this paper to knowledge-based resource evaluation and management, consists of a qualitative/quantitative approach that mitigates the “inherent” risk of discretionality in the definition of the perimeter of each intangible entity to be evaluated, not involving any direct judgment on the IAs themselves. The proposed solution also provides some diagnostic tools for a further analysis of the portfolio of validated IAs which are returned at the end of the procedure.

1.1 The procedural mitigation of the discretionality risk

This purpose is reached in a procedural way: by the use of a qualitative/quantitative procedure (in order to appreciate the complexity of the IA-structure) in spite of totally subjective judgments (the traditionally given ones). This is done by the formalization of a protocol whose goal is to provide the IA recognition process with a standard procedure. This allows the traceability of the whole process and an extended vision of the interconnected intangible portfolio under a value-creation perspective. This identification goal is achieved by means of a bottom-up analytical procedure, which returns quantitative-validated constructs. Therefore avoiding the main risk of total subjectivity that is unavoidably implied with the use of preset categories, which are detached from the case-specific context. And, even if the discretionality risk, theoretically, can never be totally removed since – like in every type of evaluation – the data entry relies on judgments by individuals, it is, however, true that the traceable computation that this framework allows is a great step forward from the traditional simple subjective tagging of what an individual analyst believes to be a unequivocally defined intangible resource.

The paper is structured as follows. Section 2 analyzes the theoretical background. Section 3 unfolds the research goal, explains the research approach and the logic behind the proposed idea. Section 4 illustrates step-by-step the Intangible Portfolio Identification and Clustering (IPIC) procedure. Section 5 has been designed as a calculation section, outlining a practical application from the proposed theoretical basis. As a final point, Section 6 summarizes the conclusions of this paper.

2. Theoretical background

Identification, classification and appraisal of the macro-category of strategic assets have always been considered key requirements for successful strategic management and for an adequate business development policy (Wernerfelt, 1984; Grant, 1996; Peteraf, 1993; Barrera-Martinez *et al.*, 2011) and also for a consistent assessment of the firm’s value (Lev, 2001; Hung, 2004). However, there is still limited consensus on how to reckon, classify and assess them. And this is markedly true for intangible resources.

Intangible resources are also known as knowledge based assets, but various other equivalent terms are used in literature (Kaufmann and Schneider, 2004; Choong, 2008). Among IAs we can mention intellectual property rights, trademarks, information technologies (databases, network relationships with customers, academia and suppliers), and “skills” (i.e. capabilities), such as employee competencies, routines and culture (Bontis, 1996; Davenport and Prusak, 1998). More widely, Stewart (1997) defined the Intellectual Capital (IC) as “the intellectual material – knowledge, information,

intellectual property, experience – that can be put to use to create wealth,” and, not surprisingly many articles regarding IC have focussed on value creation, as it maximizes value or enhances business performance (Kujansivu, 2009). First research works about IC published in the latest 1990s were specifically focussed on making distinctions among the proposed terminologies (Hall, 1992; Edvinsson and Malone, 1997a; Nahapiet and Goshal, 1998): disagreement of opinions, still occurring, were based on the “complexity of the problem which is related to the number and types of relations and elements in a system” (Rescher, 1998). In particular, focussing on considering such intangibles in virtue of their relevance to intellectual categories or to their intrinsic essence.

2.1 The nexus between intangible resources and value

Several authors agree on the key-role played by intangible knowledge-based resources to create and manage a sustainable competitive advantage (Roos *et al.*, 1997; Mouritsen, 1998; Guthrie and Petty, 1999; Petty and Guthrie, 2000). Value and intangible resources are entities that are mutually entwined. According to the RBV (Wernerfelt, 1984; Prahalad and Hamel, 1990; Itami, 1987; Barney, 1991; Hall, 1992; Grimaldi *et al.*, 2013) and to the KBV (Grant, 1991, 1996; Spender and Grant, 1996; Hitt *et al.*, 2007; Chaharbaghi and Lynch, 1999), the IC is a potential source of competitive advantage since its components are comprehended in the concept of SRs (Amit and Schoemaker, 1993; Peteraf, 1993; Conner and Prahalad, 1996; Barney *et al.*, 2001) and can therefore enable value creation, when properly managed (Chen *et al.*, 2004; Kujansivu, 2009; Teece, 2000; Wiig, 1997). Even under an IC perspective, the value creation process mainly depends on the modalities of interaction among its components (Hall, 1992; Marr and Moustaghfir, 2005; Diakoulakis *et al.*, 2004; Vergauwen *et al.*, 2007; Moeller, 2009). Intangibles resources, because of their knowledge dynamics, embody the core competence of the company and directly influence the value creation process in the firm (Grant, 1991, 1996; Spender and Grant, 1996; Hitt *et al.*, 2007; Chaharbaghi and Lynch, 1999). Therefore, whatever type of assessment is conducted on the mass of the IC (and on the Strategic Capital at the same time, as a wider logic category containing the former), it should be primarily based on the identification/categorization of those components which can drive organizations to a higher degree of competition by improving the value creation process.

Most of measurements of companies' IAs are characterized by an array structure where they are distributed and classified by “balanced scorecard” (Kaplan and Norton, 1996), or holistically measured to give an “intellectual capital index” (Roos *et al.*, 1998), or arranged by means of five IC perspective in the “Skandia business navigator” (Edvinsson and Malone, 1997b). Moreover, measurement methodologies should provide not only for a static evaluation of IAs, but also for the dynamic flows interacting among them, in order to return a “comprehensive” economic evaluation of the contribution of intangibles to the value creation (Michelino *et al.*, 2014), while tracing the direct or indirect capability of each asset of influencing the organizational economic performance. More specifically, some authors consider IC as the missing link between the management of IAs and organizational performance, and assess the firm value creation by making use of IC concept (Roos *et al.*, 2005). So, methods of measuring and managing the dynamics of knowledge assets have been developed (Nissen *et al.*, 2000; Schiuma, 2009; Solitander and Tidström, 2010), while, at the same time, methodologies and guidelines adopting a flow approach to study the cause-effect dynamics among IC elements have been suggested (Meritum, 2002; Ricceri, 2008).

Another measurement system used to measure the value contribution of intangible resources was the Conjoint Value Hierarchy (CVH). It was developed by Pike and Roos (2004)

to take real-world performance measurements from multiple stakeholders and multiple design attributes and assess their relative merits. The CVH factors performance measures and calculates the value of entities up to and including whole businesses but without the usual disadvantages of traditional conjoint analysis (Pike *et al.*, 2005, 2006). In comparison to other IC approaches, such as the IC Navigator (Fernström *et al.*, 2005) and the in-built indicator system known as the IC Index – which are strategic approaches rather than specific measurement approaches – the CVH is a high-precision measurement approach originating from measurement theory.

2.2 Inherent interdependence of IAs

The IAs entities identified in literature (Boedker *et al.*, 2004; Choong, 2008; Petty and Guthrie, 2000; Green and Ryan, 2005; Marr, 2008; Corvello and Iazzolino, 2013) can be adequately classified according to some criteria (e.g. Edvinsson and Malone, 1997a, b). But when it comes to cluster such knowledge-based intangibles resources accurately, some critical bottlenecks show up. Because their boundaries are not well defined and physiologically fuzzy. Choong (2008) suggested that “inconsistency and overlap of classes and sub-classes occurs frequently and there is no agreed classification schema.” And in many cases it is quite hard to trace a sharp line between them, using whatsoever top-down criterion. The know-how that is embedded in business unit is characterized by human, structural and relational components that coexist and complete each other at the same time: and the final blend is totally case specific. Collis (1994) stated that IAs are interrelated and interdependent, deducting that their value is context specific. Sveiby (2001) illustrated many of the mutual influences among individual knowledge and competences, organizational internal structure and its external relationships.

2.3 Specificity-aware clustering

Therefore, considering the above illustrated assumptions, any assessment approach that is intended to be accurate, could be hardly considered fully consistent without factoring the above two aspects: mutual interactions among IAs and the value-perspective. Starovic and Marr (2003) investigated the reciprocal influences of some IAs in a value creation perspective. As Estivill-Castro noted (2002), the issue of an “objectively correct” clustering solution to be used involves the specificity of the nature of the entities to be examined, since it cannot be predetermined without getting biased. Each candidate clustering approach differs from the others on the basis of cluster definitions and specific demarcation policy of their edges (Dierickx and Cool, 1989; Roos *et al.*, 1997; Teece *et al.*, 1997; Yip *et al.*, 2015). Nevertheless, both of these two factors come with the risk of being markedly discretionary. Therefore, a more convenient and effective solution can be found thinking “laterally.” Focussing on the concept of value creation has the benefit of being definitely less fuzzy and questionable (Stabell and Fjeldstad, 1998; Srivastava *et al.*, 2001; Newbert, 2008; Peteraf and Barney, 2003) and subsequently unfold such a monolithic value-entity into basic interrelated sub-elements (Battagello *et al.*, 2014a) that can be used for our purpose.

2.4 The validity of subjectively captured information

There is general agreement on the specificity of IAs of every organization, as a result of their linked relationship to its business context. Subsequently, only managerial perceptions can properly shape knowledge resources to the organizations and even suggest the most adequate and relevant measurement indicators for those aspects which concur to the achievement of missions and goals of companies (St Leon, 2002;

Hafeez and Essmail, 2007). It is well known that perceptions of managers are crucial to peruse data received from multiple sources, establish the relevance of information, develop alternatives and characterize strengths and weaknesses. Perceptions of decision makers are regularly applied to interpret and evaluate any kind of information at every level of performance attributions and decision processes, and scientists have examined the effects of their perceptions accurately (Mezias and Starbuck, 2003; Winter, 2003). However, dissenting perceptions among the various managers and also between top and middle management can emerge in value assessment process, both in small and medium sized and in larger organizations. In order to provide the most unbiased perspective to achieve competitive advantage, scientists have developed multi-criteria decision analysis systems. Among these multi-criteria decision systems, both the analytic hierarchy process (AHP) and the analytic network process (ANP) use a system of pairwise comparisons to measure the weights of the elements of the hierarchic path and to rank the alternatives in the decision (Saaty, 1980). Furthermore, in case of a panel of interviewees, the consistency of the process will highly benefit from the use of a gathering methodology such as the Delphi method (Chu and Hwang, 2008). Applications of these systems can be found in a number of research areas, such as economics, social, political and technological sciences. In the present research field, AHP and ANP have been applied to strategic management choices (Tavana and Banerjee, 1995); to devise a “value creation index” (Low, 2000); to design a “strategic analysis technique” (Carmeli, 2004); to assess IAs weights (Green and Ryan, 2005).

3. Research project outline

According to the previous literature review, the appraisal of the IAs held by a company represents a crucial point, since such entities are mutually entwined with value creation, therefore their gauge represent a milestone in measuring and managing business performance. Nevertheless, before coping with this task, such issues involve the propaedeutic unambiguous recognition of the very set of entities that should be audited. Furthermore, considering the fuzzy nature of IAs, the definition of each intangible entity (and of their final collection as well) should be considered consistent in the first place, in order to avoid biased conclusions based on them downstream. Therefore the preliminary footprint logically lies in their reliable identification, since from that choice depends the correct appraisal and allocation of the knowledge-based intangible resources and the reliability of knowledgeable strategic decisions.

A feasible solution to approach this relevant key-issue is designing a methodology that is capable of linking the intangible entities “to-be-studied” to value creation, on the one hand. Plus, allowing an unbiased identification of the set of IAs, on the other hand. This can be achieved by the means of a procedure that takes advantage of a bottom-up approach in their recognition.

3.1 A “bottom-up” logic-workflow

Every company in the world comes with a unique blend of specific IAs, as underlined by the RBV and the KBV. But each blend physiologically comes with different mutual relations among its components. Therefore, even if some IAs are labeled the same way among different companies: their genesis, their inner mechanisms, their way of generating value are all case-specific, since knowledge-dynamics are so. Starting the assessment process from constructs (IAs) that are outlined as some “previously set” aggregates, the risk that some meaningful meta-info about their composition and their underlying

value-drivers gets lost, is prominent. Such valuable knowledge can be easily retrieved by starting the analysis from their building components, instead (Xu and Giunchiglia, 2015). Since they are individually free from any imposed categorization.

In order to avoid all that, a possible solution comes from thinking “bottom-up”: first, defining the basic building blocks of the entire intangible set. And only next, aggregating them into IAs. In addition to the informational-value benefits, the recognition of value-based building blocks, would also provide the entire auditing process with a value-oriented traceability. It would also mitigate the risk of distortions caused by performing the clustering in a discretionary way, since basic entities that can be easier comprehended and also measured. An example of a methodology used to keep the clustering process unbiased by the means of a quantitative analysis for tagging such fuzzy entities effectively is discussed on the application of the Intellectual Capital Ontology Analytics (ICOAN) procedure (Battagello *et al.*, 2014b).

Once atomized the whole blend of value-drivers of the company into basic-level entities, their relations can now be analyzed in terms of intensity of mutual interactions in order to assess the strength of the connections among them. By studying their relational network, it is possible to map them: they will function as nodes of a value-network, whose arches are represented by the intensity of their weighted connections.

The task of retrieving pertinent values can be accomplished by questioning directly to the ones who manage such resources on a daily basis. This is done conducting an interview-based data-entry among the management of the target company, in order to audit the impact and the mutual relevance of each entity among the value system. In order to grasp their knowledge about that and distill it into a viable qualitative/quantitative form. Therefore, taking into account the different intensity of such connections, the whole set of entities can be clustered and re-aggregated into meaningful higher constructs, according to the bindings recorded among single nodes.

The design of an appropriate clustering technique is crucial, in order to take into account the specific requirements related to the IAs. The resulting clusters will represent the SRs actually utilized by the company for creating value. In particular – magnifying the focus to knowledge-based intangible resources, according to the KBV – they can be considered the collection of the company’s IAs *stricto sensu*. Whose perimeter definition is case-specific and value-system dependent, with no need for any preset (and biased) definition for them chosen upstream.

4. Blueprinting the IPIC methodology

In order to achieve the research goals above illustrated, an across-the-board framework is proposed in compliance with the logic workflow outlined in Section 3. The IPIC procedure consists of four main sequential phases (plus a preliminary one), unfolded in nested sub-steps. Each phase returns some deliverable outputs and analytics, which can be used as benchmarking indicators (Table I).

The ideal workflow is structured as follows, from a logic standpoint:

- (1) A preliminary strategy auditing phase, in order to highlight how value is actually created within the target company. And how it is related to its strategy alignment, within the case-specific business model.
- (2) The first phase is focussed on value-creation oriented sorting (value branching): for outlining clusters, sub-elements identification and mapping their relational connections. This step returns the detection of the basic building blocks of the value creation process: the value objects (VOs).

Table I.
Phase-overview of
the IPIC procedure

Phase	Description	Outputs/indicators
0	Preliminary strategy assessment	Business model concept and value map
1	Value Tree branching (atomizing to VO-level)	Value Tree – VOs identification
2	Appraisal of existing interactions-raw clustering	Value Tree – VOs identification
	Interaction Matrix (data entry from pairwise-based interviews)	Criticality analysis: impact graph
	Computation of the Proximity Matrix	Criticality analysis: impact ranking
	Threshold analysis	Threshold definition and bar chart Identification of candidate aggregates (CIAs)
3	Cluster refining	
	Acid-test	Refining of the number of CIAs by checking the criteria matching
	Redundancy check	Membership redundancy grid
	Routing of ungrouped and unlinked entities	Generic IA (Goodwill) definition Stand-alone IA detection
4	Final grouping of aggregated intangible assets	Neighborhood graph Cluster cohesion analysis

- (3) Quantitative appraisal of the existing interactions among the basic entities above detected. Building of their Interaction Matrix and calculation of the corresponding Proximity Matrix for assessing the weight of their impact-relations. Identification of candidate intangible aggregates (CIAs) via the gauge of a Threshold Value.
- (4) Clustering of the aggregated VOs. First, the identified CIAs are evaluated by running a criteria-matching Acid-test. Next, a membership redundancy grid is built in order to check redundancy and overlapping among the CIAs. Last, ungrouped and unlinked entities are audited and arranged.
- (5) Grouping of the resulting list of validated CIAs into a concluding collection of IAs, outlined in a neighborhood graph, consisting of the outputs of phase-1 gauged by phase-2.

Along with the identification of the definitive array of IAs, this methodology comes with a set of indicators, whose screening returns further information about the composition of the network of VOs that models the knowledge-based resources. Such indicators provide some meaningful analytics above the mutual relations within the system. Those figures can be useful also for evaluating the involved resources via a disclosure of their criticality.

4.1 Preliminary phase: strategy assessment

Considering that the idea behind the appraisal mechanism is splitting the concept of “value” into its elementary components (but also keeping track of their relations), a preliminary Strategy internal audit is highly recommended (Grant, 1991). This step is necessary in order to appraise the relationship between value creation and the strategy alignment of the company, related to its business model. The goal of this step is identifying the value-creation areas within the organization and appreciating their framing in terms of knowledge-related deliverable value, within the business model of the company. Some examples of possible solutions for a critical analysis and detection

of such crucial areas are: the Value Chain (Porter, 1985) and the strategic maps (Kaplan and Norton, 2004). Once achieved this preliminary step, is then possible to consistently sort out the related value-driven clusters of intangible entities.

4.2 Phase-1: Value Tree branching

The objective of the first scheduled phase is depicting an image, a snapshot map, of the layout of the basic building blocks of the value structure (highlighted in the previous step) within the business model. In order to clearly identify them, an effective framing solution can be easily found in clustering the detectable value-driven subcategories with a “from-general-to-particular” view. This solution finds a justification in the hierarchic classification methodologies (Bontis, 2004; Chen *et al.*, 2009; Wu *et al.*, 2010; Dumay and Rooney, 2011; Grimaldi *et al.*, 2013) used for the appraisal of the contribution of IAs to valuable corporate knowledge (through the knowledge substratum that they create and make flow) within the organization. This “Russian dolls” – like approach, due to its simplicity and linearity, can ease the structural representation of the “value structure” of the organization, whatever complex it could be. This technique has been successfully used at this purpose in case-study applications of the 7SF methodology (Battagello *et al.*, 2014a), revealing the resource-based value system of the target companies.

That is achieved through the comprehension of the contribution of the SRs to value generation (Figure 1), from a resource/KBV of the company in terms of value creation (Wernerfelt, 1984; Prahalad and Hamel, 1990). The keystone is the deliverable value (i.e. the root-level), appraised via three sub-steps:

- (1) This sub-step starts from sorting out the entire business model into “Value Domains” detected as necessary ones for core and support activities (Porter, 1985), whose exploitation enables value creation for the stakeholders and that can lead to competitive advantage. With that value-based criterion in mind, from now on the focus will be only on those explicit domains detected as value-creating ones.
- (2) The next sub-step consists of looking in such value domains for identifying the “Value Components” (i.e. those SRs components which embody the working factors that are required for value creation and transfer for a specific value domain) which characterize them. The number of value-components levels is not to be intended as predetermined, as well. On the contrary: one, two, *n*-levels need to be considered in relation to the case-specific value-chain complexity and

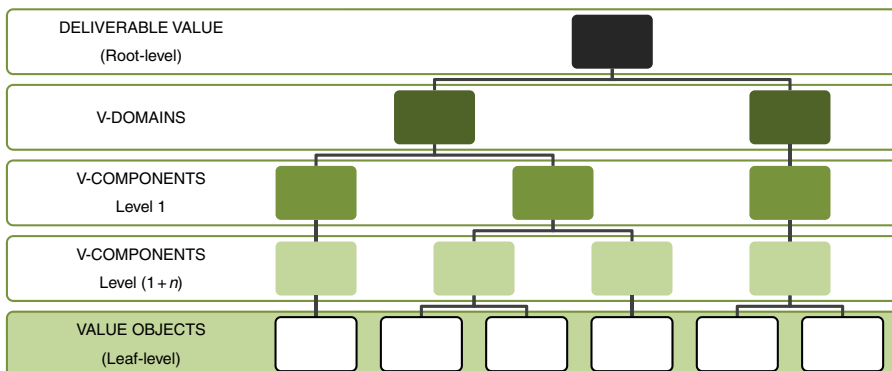


Figure 1.
Value Tree
branching scheme
specimen

to the relations among the identified components themselves. The number of nested levels depends on the detail degree needed to clearly depict how the value system is structured. As a result, for every “ n ”-level value component, there can be “ $1 + n$ ”-level value sub-components (i.e. the required factors, from a functional standpoint, whom a specific previous-level value component depends from). And so on, in a cascade manner.

- (3) Phase-outputs: this magnifying procedure comes to an end when arriving to the basic building blocks of the value system. Where no further specification is possible, the final clustering level is labeled as VOs. At last, in a fully exploded view, the VOs network is now unveiled. Such basic entities must be considered as the building blocks of the SRs systemic structure, through which we can look at the value creation attitude of the business model. And the relational outfit of such factors depicts the knowledge substratum at the basis of the KBV (Grant, 1996), so feeding the company’s competitive advantage.

4.3 Phase-2: appraisal of existing interactions – raw clustering

In this phase a quantitative appraisal of the existing interactions among the basic entities above detected is conducted, returning a collection of CIAs as a final output. Furthermore, it also provides some analytics about the interconnections between the VOs. This is done via three sequential nested sub-steps: building of the Interaction Matrix among VOs; calculation of the corresponding Proximity Matrix for assessing the weight of their impact-relations; identification of CIAs via the gauge of a Threshold Value.

4.3.1 Interaction Matrix. Given any VO (identified from the previous Value Branching procedure), the present sub-step focuses on assessing the network of relationships that link each single VO to the others from a quantitative perspective. The resulting snapshot of this network portrays the actual knowledge dynamics among its nodes, in terms of mutual influence. This goal is achieved building an Interaction Matrix (1) related to them. The values that will populate the matrix are measured by means of received/given impacts among the studied entities, assessed via pair-wise comparisons among them:

$$\text{Interaction Matrix} = \begin{bmatrix} SL_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & SL_{22} & a_{23} & \dots & a_{2n} \\ a_{31} & a_{32} & SL_{33} & \dots & a_{3n} \\ \dots & \dots & \dots & \ddots & \dots \\ a_{m1} & a_{m2} & a_{m3} & \dots & SL_{mn} \end{bmatrix} \quad (1)$$

where the meaning of every “ a_{ij} ” position within the square matrix (“ $m \times n$ ”, where “ $m = n$ ”) is the following: how much the VO corresponding to the “ i th” position is impacted (i.e. influenced) by the VO corresponding to the “ j th” position.

The values on the diagonal are traditionally considered null, but in this case they come with a further meaning, that can be useful when clustering the entries. They account for potential self-loops. The score to be put there is the answer to the question: “Does this VO impact itself by the fact that the aftermaths of its usage work in a virtuous circle, thus feeding itself loop-wise?” Then it is quantified by the same scale of the other entries of the matrix. Considering that we are speaking about

intangible entities based on knowledge, such an autopoiesis-like phenomenon is highly possible (and quite desirable indeed), as illustrated by qualified literature (Nonaka and Takeuchi, 1995).

The task, regarding how the figures populating this matrix are retrieved, is accomplished simply interviewing the individuals that have to deal with those entities on a daily base: the management of the company. Indeed, like the two previous phases of the proposed methodology, also in this step the contribution coming from the “knowledge of the system” held by its experts (the management) is crucial for the assessment of its components. Especially about their mutual relations, based on their interconnected influence, from a quantitative perspective. From a data-entry standpoint, this can be done in several ways. Some possible techniques range from a simple weighted score-repartition scale to multiple attribute decision-making (MADM) methodologies. Furthermore, the allowance to use natural human language in the expected valuations, instead of raw number verdicts, could help in obtaining a more consistent appraisal from the interviewee. What is more, a valuable solution that can be successfully used is a fuzziness-aware one. In this case, the main benefits are related to the fact that the judgments about such impacts can be hardly perceived as sharp ones by any interviewee. Therefore their appreciation could be enhanced by the use of such a methodology whose main feature is taking into account fuzziness among the perception of the categories to be analyzed. Since “the main characteristic of fuzziness is the grouping of individuals into classes that do not have sharply defined boundaries” (Hansen, 2005), accordingly, their measurement can be adequately represented by a fuzzy number. A wide range of Fuzzy-MADM methods (e.g. FAHP, FTOPSIS, FGRA, VIKOR, FDELPHI, FCM, hybrid-methodologies, etc.) are eligible to be used at this purpose (Tzeng *et al.*, 2005; Wang *et al.*, 2010; Kaya and Kahraman, 2010 and 2011; Cavallaro, 2010; Shen *et al.*, 2010; Jing *et al.*, 2012; Daim *et al.*, 2012; Deng, 1989; Calabrese *et al.*, 2013). The output of each possible technique chosen by the practitioner is, however, an array of fuzziness-aware figures, which can be successfully applied to accomplish this task. Last, in case of a panel of interviewees, the consistency of the process will highly benefit from the use of a gathering methodology such as the Delphi method (Chu and Hwang, 2008).

4.3.2 Proximity Matrix. The second sub-step consist of calculating the corresponding Proximity Matrix (cost-aware matrix) starting from the Interaction Matrix, whose purpose is calculation of the weight of the impact-relations among VOs. This step provides a measurement of the strength of the links among the value network, by the reckoning of combined pairwise impacts among all the elements of the Interaction Matrix:

$$\text{Proximity Matrix} = \begin{bmatrix} SL_{11} & b_{12} & b_{13} & \dots & b_{1n} \\ - & SL_{22} & b_{12} & \dots & b_{2n} \\ - & - & SL_{33} & \dots & b_{3n} \\ - & - & - & \ddots & \dots \\ - & - & - & - & SL_{mn} \end{bmatrix} \quad (2)$$

where:

$$b_{ij} = a_{ij} + a_{ji} \quad (3)$$

where the values of every “ b_{ij} ” position within the resulting matrix are calculated as the sum of the mutual corresponding values from the Interaction Matrix. The choice to use

addictiveness in the value contribution equation was taken because, in order to assess the strength of the link between two nodes (the VOs) of the value network, the whole weight of the relationship represented by the flow of impacts is considered: therefore both inbound and outbound ones. The meaning of each entry of the matrix is the following: how much – in total – the two considered VOs are mutually impacting each other.

4.3.3 Threshold setting. The last sub-step is intended to identify a collection of proto-assets, some possible aggregates of VOs, to be validated by the means of phase-2. The perimeter of belonging to such constructs is delineated via the gauge of a Threshold Value. The logic behind this criterion is the following: among the whole value network there is an average degree of interdependency among the nodes that can be measured. It represents the Threshold Value. If among a subset of those nodes a certain value – superior to the threshold – of intensity of their mutual links is detected, then they are supposed to rely on a stronger connection. This delimitates a perimeter: every extra VO – even near, but that does not reach the Threshold Value – is supposed to be removed from that list. While the identified VOs function together because of the level of their mutual links and such subset is eligible to be considered a potential IA. Therefore they are tagged as a CIA altogether:

$$\text{Threshold Value} = \text{Arithmetic Mean} + k \quad (4)$$

where “ k ” must be interpreted as an optional adjustment-parameter, in case of need to fine tune the sensitivity of the model. The Proximity Matrix is supposed to be validated by the means of (4) row-by-row. Each CIA_m contains only the elements that satisfy the equation:

$$b_{ij} > \text{Threshold Value} \quad (5)$$

So that, for each row of the matrix, every “ b_{ij} ” is compared with (4): if (5) is true then the corresponding couple of VOs is admitted into the CIA_m . If not, that specific “doubleton” will not be part of that specific CIA_m . The process is going to be reiterated for the following rows, till the computation is completed for all the rows. After the reiteration of this procedure a roster of CIAs is populated. A bar chart can be used at this purpose, to represent the situation via a visual output (as illustrated in Section 5).

4.3.4 Phase-analytics: criticality analysis. Some analytics can be applied to the figures resulting from (1) and (2). A calculation of the total interactions for each VO populates an impact ranking list of such entities. Such an inventory, once ordered descending-wise, highlights their position in terms of impacts among other ones. Each score comes from the combination of both inbound and outbound flows. The underlying line of reasoning is: the more a VO is “sensible” (subject to generate impacts as well as being impacted by other nodes), the more it should be considered a critical element of the value network. For every VO_x , the records admitted in the criticality ranking are calculated via the Critical Score (CS) as in the following equation:

$$VO_x \text{ Critical Score} = \sum_{j=1}^n b_{xj} + \sum_{i=1}^m b_{ix} \quad (6)$$

A further stage of this analysis can be conducted monitoring separately the inbound and the outbound relations among VOs. This leads to the definition of two separate

series of values for each VO. The results can be plotted on a Cartesian criticality graph (see Section 5 for an example) for a quick intelligible view of the actual situation, also comparing the position of the values with their median. A Criticality Balance Index (CBI) can be built (7) and applied to each VO_x . With a cost/benefit criterion in mind, it shows the measure of how much each VO is balanced between the received and the delivered impacts:

$$CBI_x = \frac{\sum_{j=1}^n a_{xj}}{\sum_{j=1}^m a_{ix}} \quad (7)$$

4.4 Phase-3: cluster refining

In order to cluster the aggregated VOs properly, the first task is to check the potential standalone existence of every the candidate intangible resources previously detected, so that their grouping could be considered a consistent IA. Then, the main side-effect to avoid is some "IAs redundancy," since single composing elements (VOs) cannot be counted multiple times. Last, the ungrouped and unlinked VOs should be arranged considering the whole IC.

4.4.1 Acid-test run for criteria-matching and parent-grouping check. In order to check the potential standalone existence of every CIA, an Acid-test should be run. This is necessary for testing the matching of the target set of VOs with some criteria that guarantee that their grouping could be considered a consistent IA. A pragmatic but effective guideline to identify which CIAs – among the detected ones – are subject of standalone valuation, is the following one (Brugger, 1989). It is based on three requirements. Each detected candidate IA should be:

- (1) R1 – object of investment flows (i.e. cost centers) that produce benefits deferred in time;
- (2) R2 – independently transferrable; and
- (3) R3 – measurable in terms of value (e.g. source of quantifiable differential economic/financial outputs).

Considering that the requirements proposed by Brugger (1989) are related to a financial evaluation of the IAs and that the purpose of our research goal has not a direct finance-focus, the "independent transferability" requirement should be more properly considered as a "minimum relative independency" from parent oversets under a "going concern" situation. Interpreted in this way, this test will avoid the occurrence of Russian-doll effects, reducing the number of CIAs. Indeed, when several test-compliant CIAs are proposed, it declassifies the fully included ones from the roster. Any CIA must be considered included in another one, when it is a subset: all of its VO members are listed in the candidate parent one. Only the CIAs that pass the test are supposed to be admitted to the next phase sub-step.

4.4.2 Redundancy and overlapping check. Coherently with the present framework, all the VOs are supposed to be grouped according to some criteria. But the boundaries of every IA are physiologically "floating" and they depend on the shade and the approach that the analyst will use. Therefore, any *deus ex machina* definition could be basically used. The only real issue to be aware of, is the risk of lack of inner coherence. It is not predetermined where the line between each IA must be drawn, but it is necessary to respect the selected criterion for every IA, once it is chosen. This is necessary since

single composing elements (VOs) cannot be counted multiple times (as “Principle of Not-Redundancy”), otherwise it will jeopardize the overall evaluation (Guatri and Bini, 2005) – resulting in an overestimation of the IC/Strategic Capital.

Therefore, a membership redundancy grid (see Section 5 for a sample) is built in order to check redundancy and overlapping among the remaining CIAs. This is done via a Redundancy check. For every VO included in multiple conflicting CIAs: consider it belonging to the one where the arithmetic mean of incoming impacts that it receives by inherent VOs is higher (8); and subsequent deletion of the target VO from the ones that impact it with lower mean values:

$$VO_x \in CIA_y : \max \frac{1}{n} \sum_{j=1}^n a_{xj} \forall a_{xj} > 0 \quad (8)$$

The reason why only positive values are considered is that otherwise the result would be distorted by the magnitude of the set which is already the largest one (in case of a raw-sum computation), that therefore will tend to become ever larger. Or, in case of a simple mean computation, by the presence of not-influencing entities within the group.

4.4.3 Routing of ungrouped and unlinked entities. Also ungrouped and unlinked entities are supposed to be audited and arranged.

VOs whose connection values do not reach the threshold for any candidate, so that they cannot be listed in any other CIA and/or do not pass the Acid-test, therefore cannot be included in the whitelist of IAs. Those ungrouped entities form the generic mass of the intangible substratum. Highly qualified literature (Guatri and Bini, 2005) described this phenomenon in details. Indeed, in case of not explicit emerging IAs, what remains ungrouped (CIAs composed of only one member must considered null) is, however, supposed to be appraised. This amorphous mass is what composes the firm’s Goodwill, to be considered as a background “generic IA” (Guatri and Bini, 2005).

Last, among the generic collection of unclassified VOs that form the Goodwill, is now possible to detect the existence of singleton IAs. This can be done checking the Self-Loop values recorded on the Interaction and proximity matrices (1 and 2) along their diagonal. For unlinked entities: if such scores are higher than the Threshold Value (4) and they are also Acid-test compliant, then they can be considered as stand-alone IAs themselves.

4.5 Phase-4: final grouping of aggregated IAs

The last phase of the proposed methodology is dedicated to the final representation of the validated CIAs according to the best fitting connection-layout. From the screening of the strength of the connections among all the VOs that form the CIAs, the different values recorded within every validated cluster return the objective identification of the more convenient rendering of the value network, viewed with an intangible resource perspective. This phase works as a support system for itemizing them properly. The grouping of the resulting list of validated CIAs into a concluding collection of IAs, is outlined in a neighborhood grouping graph, basically consisting of the outputs of phase-1 gauged by phase-2 (see Section 5 for a sample). This is made by the means of a proximity-based grouping, to avoid the overlapping of different clusters, representing a matrix-based Space Adjacency Analysis (White, 1986). The Proximity Matrix (2) can be directly used at this purpose, according to the recorded values between VOs: the higher

the value between two VOs, the closest they will be represented on the graph and vice versa – mandatorily considering the accordance to the IA layer (i.e. the IAs they belong to).

4.5.1 Phase-analytics: cluster cohesion analysis. Some analytics can be applied to the final list of IAs resulting from the grouping. For each IA, the Cohesion Index (9) factors a separate calculation of the arithmetic mean (μ) of the interactions within every cluster – resulting from the Proximity Matrix – which can be compared to the Threshold Value. This is done in order to quantify the strength of the inner interactions within the identified and validated clusters, highlighting in a ratio the weight of their score to the average; next ranking them accordingly:

$$IA_y \text{ Cohesion Index} = \frac{\mu(b_{ij}) \in IA_y}{\text{Threshold Value}} \quad (9)$$

Last, the weighted version of this relative index can be obtained by normalizing its numerator by the maximum score reachable by the values in the Proximity Matrix (i.e. for “0-1” range in the Interaction Matrix, it means: “2”).

5. The IPIC at work: simulation model and workflow outline

In order to validate its usability, the IPIC methodology has been deployed on a numerical simulation. This calculation section is meant to illustrate the suggested workflow for an effective application of the proposed methodology. This schematic numerical description, can be also helpful as a guideline for implementing this procedure on companies in real life context. It is divided into sub-paragraphs matching the IPIC procedure scheme: the workflow is unfolded in order to help the practitioner to better budget resources and time for that. In addition to the preliminary phase-0 (that obviously cannot be detached from a real case study), the application of phase-1 and the beginning of phase-2 should be focussed on the dialectic interaction between the analyst and the firm’s management via interviews, in order to reckon the knowledge base required as input for the proposed workflow. Therefore, in this example such data will be taken for granted and we will just provide the subsequent Value Tree (as the output of the Value Branching process) and the scores resulting from the interviews as data entries for the Interaction Matrix (0-1 range).

This simulation works as a live example of the typical situation that illustrates the beginning of an assessment audit. We assume that we have no knowledge at all about the IA-structure of the target company. While at the end of the procedure we will possess a clear map of the intangible resources (or of the SRs, depending on the adopted focus) and of their interrelations. And this without giving any direct subjective judgment on them or even any attempt of top-down classification. Actually, there is no need of preset constructs simply because they will be in-built bottom-up wise.

5.1 Phase-1: value branching. output: value tree

The protocol starts with the identification of the basic building blocks (VOs) of the value structure of the hypothetical company. In this example it is assumed that the procedure eventually detects seven basic units (VOs). This achieved output from this phase will be used as the input for the next one (Figure 2).

5.2 Phase-2: appraisal of existing interactions – raw clustering

Once identified the VOs, it is now possible to proceed with the study of their interactions. The goal of this phase is to return the following intermediate deliverables and outputs:

- (1) Interaction Matrix (Figure 3), Proximity Matrix (Figure 4), Threshold Value (Figure 5);
- (2) List of CIAs (Figure 6); and
- (3) Criticality analysis: ranking, graph and Balance Index (Figure 7).

A quantitative appraisal of the existing interactions among the basic entities above detected is conducted. In this hypothetical situation, the figures that populate the Interaction Matrix are assumed to come out from the interview procedure. Next, the

Figure 2. Value Tree scheme, highlighting the resource-based value perspective

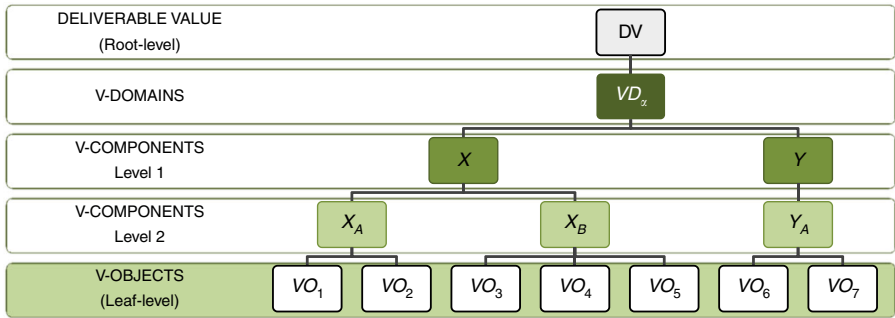


Figure 3. The Interaction Matrix (with heat-map)

			VO_1	VO_2	VO_3	VO_4	VO_5	VO_6	VO_7	TOT
VD_x	X	X_A	VO_1	0.7	0.9	0	0	0.2	0	1.8
		VO_2	0.2	0	0.3	0	0	0.6	1.1	
		VO_3	0.8	0	0	0.3	0	0	1.1	
		VO_4	0	0.3	0.1	0.8	0.7	0	1.9	
	X_B	VO_5	0	0	0	0.7	0.7	0	1.4	
	Y	Y_A	VO_6	0.2	0	0	0.6	0.7	0	1.5
		VO_7	0	0.6	0.3	0	0	0	0.9	
TOT		1.2	1.6	1.3	1.6	1.8	1.6	0.6		

Figure 4. The Proximity Matrix and the Threshold Value

VO_1	0.9	1.7	0	0	0.4	0
	VO_2	0	0.6	0	0	1.2
		VO_3	0.1	0.3	0	0.3
			VO_4	1.5	1.3	0
				VO_5	1.4	0
					VO_6	0
						VO_7
Threshold Value	0.46					

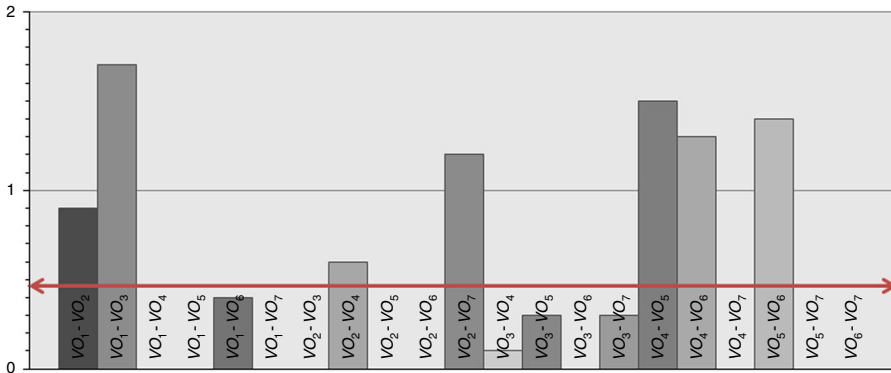


Figure 5. Validation of the scores from proximity matrix via the Threshold Value

	VO ₁	VO ₂	VO ₃	VO ₄	VO ₅	VO ₆	VO ₇
CIA _a	x	x	x				
CIA _b		x		x			x
CIA _c				x	x	x	
CIA _d					x	x	

Note: x, symbol is a check-mark for identifying the validated VOs for each CIA

Figure 6. CIA composition Roster

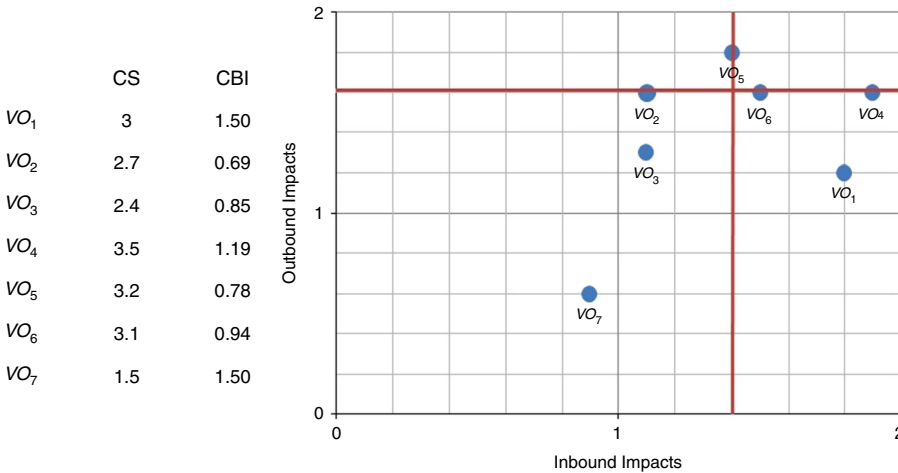


Figure 7. Criticality analysis

Proximity Matrix is compiled accordingly (Figure 4). Last, the Threshold Value is calculated from it as the arithmetic mean of the combined scores (with: $k = 0$).

The bar-chart on Figure 5 shows that only a limited number of combinations can be considered valid, since they trespass the Threshold Value. For each row of the matrix a candidate set is populated – including only the validated ones – according to such findings. This procedure returns a final roster of CIAs.

The Criticality Analysis is then conducted, returning valuable findings about the relevance of each single VO among the value network, thus easing the understanding

of the role of critical resources for value creation via the screening of the resulting scores of the CS and CBI indexes. The related graph highlights the positioning of the VOs from the calculated median. The application of the framework has returned the claimed intermediate outputs (Figures 3-7), which are necessary inputs for the next one.

5.3 Phase-3: cluster refining

The intermediate deliverables and outputs that this phase aims to return are the following:

- (1) criteria-matching and parent-grouping check: Acid-test run (Figure 8);
- (2) membership redundancy grid: redundancy and overlapping check (Figure 9); and
- (3) detection and arrangement of ungrouped and unlinked entities.

After the run of the Acid-test the CIA_d has been declassified, since it resulted to be a subset of CIA_c which is fully compliant with the three requirements itself. Next, in order to check the redundancy and the overlapping between the CIAs, the membership redundancy grid is used. The ambiguous cases are settled out by the use of the formula in (8). Subsequently, for every aggregate competing for the same VOs, the redundant VOs are simply declassified from the losing aggregates. No ungrouped and/or unlinked entities have been detected in this case, since the aggregates include the whole set of VOs.

Also in this phase, the application of the framework has returned the claimed intermediate outputs (Figures 8 and 9), which are necessary inputs for the last one.

5.4 Phase-4: final grouping of aggregated IAs

Last, the application of the framework is intended to return the following final outputs:

- (1) list of validated IAs (Table II);

Figure 8.
Acid-test run for criteria-matching and parent-grouping check

	R1	R2	R3	
$CIA_a \{VO_1; VO_2; VO_3\}$	✓	✓	✓	ADMITTED
$CIA_b \{VO_2; VO_4; VO_7\}$	✓	✓	✓	ADMITTED
$CIA_c \{VO_4; VO_5; VO_6\}$	✓	✓	✓	ADMITTED
$CIA_d \{VO_5; VO_6\}$	✓	X	✓	REJECTED

Figure 9.
Membership redundancy grid

	VO ₁	VO ₂	VO ₃	VO ₄	VO ₅	VO ₆	VO ₇
CIA_a	✓	X (0.20)	✓				
CIA_b		✓(0.45)		X (0.30)			✓
CIA_c				✓(0.75)	✓	✓	

Table II.
Final roster of the intangible assets and cohesion index scores

List of validated IAs	CI	CI (%)
$IA_a \{VO_1; VO_3\}$	3.68	85
$IA_c \{VO_4; VO_5; VO_6\}$	3.03	70
$IA_b \{VO_2; VO_7\}$	2.60	60

- (2) cohesion index and ranking (Table II); and
- (3) neighborhood grouping graph (Figure 10).

From the previous phases a resulting roster of validated IAs is distilled on Table II. This list can be ranked after the Cluster cohesion analysis, that shows the difference strength of every asset, calculated factoring its internal cohesion by the means of the inner interactions within every cluster: the first index highlights the comparison with the threshold level, while the second can be used as a weighted benchmark.

Last, the neighborhood grouping graph is sketched taking into account the proximity requirements, derived from the Proximity Matrix in terms of intensity of the inner connections among VOs (bidirectional).

While at the beginning of the procedure we intentionally started from a situation where we openly knew nothing about the inventory of the IAs held by the firm, we are now in the position to state that the target company is characterized by three IAs emerging from three different areas (IAa-Iac), as in Table II. The graphic tool (Figure 10) depicts a clear map of the three identified intangible resources and of the mutual interconnections of their detected composing elements. On which the analyst can now target a proper evaluation technique and the management of the company can now mindfully leverage to improve business performance and strategy alignment.

6. Conclusions

The idea behind this study comes from the observation that an unbiased identification and clustering of the knowledge-based resources – grouped in IAs – existing in an organization is not achievable by using a traditional top-down tagging approach. Therefore jeopardizing any reliable appreciation of the IC. In fact, even though it is quite common to find some IAs labeled exactly the same way among different companies, their genesis, their inner mechanisms, their way of generating value are extremely different. As well as the rational recognition of the boundaries between each of those entities, which define their perimeters within the IC/strategic capital. This is because the complexity and the relational-fuzziness makes the knowledge-dynamics forming the IAs totally case-specific. Since they are affected by causal ambiguity, path dependency and

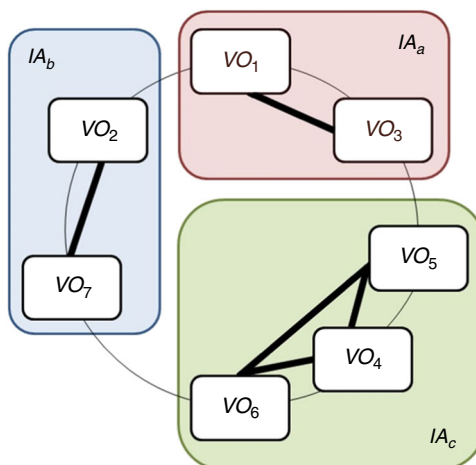


Figure 10.
Neighborhood
grouping graph

social complexity. Therefore, if such issues were not factored, they could be highly distorting when conducting a business evaluation. In order to avoid this hazard, the IPIC methodology has been designed around the simple idea of bypassing the problem. Not judging the IAs themselves directly, but on the basis of their knowledge-based basic building blocks, on which a judgment is more attainable: bottom-up wise. What is more, those atomized entities are resulting from a value-creation hierarchic audit, linking their perception to a less fuzzy and more consistent concept.

6.1 Findings

Considering that there's no unanimous consensus (both in literature and among the practitioners) on any universal definition of the boundaries of each intangible resource, this methodology has been designed as an open-framework to be able to work with every possible (past or future) one. And this mechanism works because it is based on the previous identification and gauge of smaller fragments which eventually combine together.

The expected value of the proposed methodology consisted in plotting a relation-based map of the IAs of a firm from a relational perspective: an open procedure that, out of the amorphous mass of the SRs, returned an analytic picture of its composing elements keeping track of their intertwined connections and mutual influence. Consequently, allowing the comprehension of the actual framing and relational positioning of such resources. It also returned some analytics that rendered a diagnostic snapshot of the validated aggregates, distilling valuable information than can be used in benchmarking and comparing different companies and/or monitoring the same one over time.

This identification goal was achieved by means of a bottom-up analytical protocol, which returned a roster of quantitative-validated constructs. Therefore avoiding the main risk of total subjectivity that is unavoidably implied with the use of preset categories, detached from any case-specific context. This allowed the traceability of the whole process and an extended vision of the interconnected intangible portfolio under a value-creation perspective.

Under the logic of the proposed procedure, it is crucial to notice that every assessment used as a model variable, was never given on the IAs themselves (whose perimeters can be fuzzy and/or unknown). But on the impact between the value drivers they are built on, that – from a managerial standpoint – are less fuzzy and more recognizable (Porter, 1985).

6.2 Known limitations of the present research

The data entry sections (i.e. impact assessments) of the IPIC is based on experts' opinion (the company's management) retrieval methodologies and on their awareness of the value system of the company. Consequently, from a procedural standpoint, this represents a known potential issue, since the process relies anyway on an external choice made by some "expert." Even if, compared to the situation it is aimed to bypass (i.e. the totally subjective categorization "from above"), it suffers from a different type of risk of discretionality. And definitely of a lower degree, because some techniques can be used (Saaty, 2008) for coping with accuracy, convergence, consistency and coherence issues (e.g. pairwise comparison; the "CR" parameter in AHP; the Delphi method; etc.).

6.3 Implications for practitioners and researchers

This approach could enhance the understanding of the set of intangible resources of a company forming its IC by managers and researchers, before conducting business valuations and a strategy audits, and due diligence statements.

The rational and unambiguous identification of each IA that the IPIC achieves, allows the analyst to target a proper evaluation technique on them. And the management of the company can mindfully leverage to improve business performance and strategy alignment since, following this framework, it is directly known which value drivers they are built on. So that it can be used for a more informed and rational resource allocation of the IAs themselves, investment strategy and business development.

6.4 Possible areas for future research

Once the IAs are identified, a possible further step in this research field would be the design of a complementary procedure which could provide some quantitative-based criteria to optimize the IA-portfolio on the convenience to outsource/insource such resources and the related activities, hence increasing the capability to anticipate management problems. Other possible interesting outcomes could derive from enhancing the VO-based audit, building metrics and analytics based on them.

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