



# Applying the analytic network process to disclose knowledge assets value creation dynamics

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## ABSTRACT

The recent literature grounded on the resource and knowledge-based view of the firm, has widely outlined the importance of knowledge assets as well as of the management approaches of their development. However, only few contributions have investigated the mechanisms by which these resources interact to sustain company's value creation dynamics. In particular, there is a lack of approaches suitable to disentangle those mechanisms and to explain how knowledge assets cluster and interplay in improving organisational performance.

A clear understanding of how knowledge assets take part in value creation allows to identify those knowledge assets which, due to their critical role in achieving the company's performance objectives, need to be managed and appropriately exploited.

This paper proposes a model, based on the analytic network process (ANP) methodology, to disclose and assess how knowledge assets mutually interact and take part in company's value creation dynamics. The application of the ANP allows to reveal and to evaluate the dependencies and inter-dependencies linking knowledge assets to organisational performance objectives and to set priorities among knowledge assets against targeted performance. The application of the model is tested by its application to the identification of the knowledge assets value drivers at the basis of NPDP performances improvement within an engineering company located in South of Italy.

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## 1. Introduction

Increasingly, in today's fast changing and complex economic scenario, the importance of the traditional economic and production factors considered as the engine of company's value creation dynamics is decreasing. In particular, in the last decades, the growth of new knowledge intensive businesses and the lack of success of those companies, mainly relying on traditional tangible assets, to comply with the new markets rules, have showed the importance of leveraging organization's knowledge assets (Barney, 1991; Grant, 1991; Liebowitz, 1999; Rumelt, 1984; Wernerfelt, 1984). In this regards, new theories of strategic management such as the resources-based view, the competence-based view and the knowledge-based view have argued that company's sustainable competitive advantage is closely related to knowledge assets and their management. In such a prospect, managers have increasingly

realised the importance of better understanding how to identify, combine, manage and deploy organisational knowledge assets in order to improve the most critical company's performance and, as a result, to support company's value creation dynamics.

Recently, a number of theoretical and practitioner contributions stressing the strategic importance as well as the role of knowledge assets as key value drivers for company's competitiveness has been produced (Boisot, 1998; Carlucci & Schiuma, 2004; Dierickx & Cool, 1989; Sveiby, 1997; Teece, 1998; Teece, 2000); however only few contributions have investigated the mechanisms by which these assets contribute to create value. In particular, there is a lack of approaches suitable to disentangle those mechanisms and to explain how knowledge assets are clustered and how they interplay in improving organisational performance. Although it is almost intuitive that knowledge assets operate as a bundle of assets and as such impact on organisational performance, it seems difficult to understand how they interact and impact (Lippman & Rumelt, 1982).

Grounded in the resource-based view and knowledge-based view of the firm, this paper proposes a network model, based on the application of the analytic network process (ANP) (Saaty, 1996), for disclosing and assessing how knowledge assets mutually interact and take part in company's value creation dynamics.

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In a previous research, in order to analyse the links between knowledge assets and performance objectives, the analytic hierarchical process (AHP) methodology has been proposed to disclose the hierarchical relationships linking knowledge assets to organisational performance (Carlucci & Schiuma, 2007). The adoption of the AHP methodology to disclose the relationships between knowledge assets and organisational performances has shown the relevance and usefulness of adopting multicriteria decision methods to deal with the complex issue of assessing knowledge assets within organisation against performance objectives.

However, the AHP methodology presents some shortcomings which are addressed by the ANP approach. In particular, one of the main shortcomings is related to the fact that AHP does not allow to handle the interactions and feedback dependencies between the elements of a decision problem.

The proposed ANP-based model allows to evaluate the role and the relevance of knowledge assets for the achievement of targeted business objectives by dealing with both direct and indirect relationships linking knowledge assets to performance. The disclosure and evaluation of the intricate bundle of relationships linking performance objectives and organisation's knowledge assets can have both theory and practice benefits.

From a theoretical point of view, this can benefit the resource strategic management research mainstreams. In fact, as underlined by Carmeli and Tishler, (2004), the resource based view remains an area that lacks of practical approaches and tools to identify and manage organisational resources that may, separately and interactively, enhance organisational performances. While, from a practical point of view, this offers the development of approaches and tools to support managers in their decision making regarding the assessment and management of organisational knowledge assets.

The paper is organised as follows. In the second Section, on the base of the resource-based view and knowledge-based view of the firm, the strategic relevance of knowledge assets is discussed. In particular, the interconnectedness and the dynamic nature of these assets in the value creation dynamics are addressed as well as the importance of knowledge assets for company's competitiveness and value creation. In the third Section, an ANP-based model is proposed. The ANP is analysed as a methodology to investigate and analyse the inter-dependencies linking knowledge assets to organisational performance.

In the fourth Section a case example of the application of the model is described. Finally, in the last Section conclusions and suggestions for future research are provided.

## 2. Research background

### 2.1. Knowledge assets: key factors in company's value creation

In the last decades, in order to face a dynamic and fast changing competitive scenario, companies have felt the need of looking for new differentiators and drivers of organisational performance. In such a prospect, companies have recognised knowledge assets as key sources of competitive advantage (Grant, 1991; Itami & Roehl, 1987; Nahapiet & Ghoshal, 1998; Teece, 2000). At the same time new theories of strategic management such as the resource-based view (Barney, 1991; Penrose, 1959; Rumelt, 1984; Wernerfelt, 1984), the competence-based view (Prahalad & Hamel, 1990) and the knowledge-based view (Grant, 1996; Sveiby, 2001) have argued that a company's sustainable competitive advantage results from the possession of resources that are hard to transfer and accumulate, inimitable, not substitutable, tacit in nature, synergistic and not consumable because of their use. In this regard knowledge assets represent strategic organisational resources for company's competitiveness.

In addition a company strategically differentiates from its rivals both by the imperfect imitability and substitutability of its specific resources and the ways of combining and deploying those resources. In fact knowledge resources contribute to create value not only by themselves but by their dynamic interactions (e.g. Dierickx & Cool, 1989; Penrose, 1959; Roos & Roos, 1997a; Teece et al., 1997). In this regard, Carmeli and Tishler (2004) state "interaction amongst elements is complementary in that the value of one element is increased by the presence of other elements" (p. 1261). Therefore organisation's knowledge assets, as individual resources but especially as a bundle of resources, represent important levers to be managed and exploited for improving organisational performance and to support company's competitiveness.

Although the strategic relevance of knowledge assets has been largely stressed, there is still a need of providing managers with approaches and tools to identify, starting from the company's strategic value creation objectives, the knowledge assets grounding the achievement of the targeted value propositions. This involves the understanding of the relationships linking knowledge assets to the desired business and performance outcomes. By assessing the links between knowledge assets and value objectives managers can better align investments in organizational knowledge capital for the greatest impact.

For this reasons, we believe that the following issues need to be addressed: (i) How are knowledge assets engaged, separately and as a cluster, in value creation dynamics? (ii) How is it possible to identify knowledge assets which drive company's value creation dynamics, taking into account mutual interactions among knowledge assets?

Facing these issues means to provide managers with approaches and models for identifying and analysing organisation's knowledge assets and their interactions in value creation dynamics.

### 2.2. Understanding and disclosing organisation knowledge assets

In order to manage knowledge assets, managers need to assess them. For this reason it is necessary to identify and classify the knowledge assets of an organisation. In order to provide possible methodologies for understanding and disclosing knowledge assets, the notion of intellectual capital (IC) has been proposed as a key concept to understand and evaluate the knowledge dimensions of organisations (Brooking, 1996; Hall, 1992, 1993; Roos, 1998; Roos et al., 1997b). This concept has been popularised by practitioners looking for a conceptualisation to handle the difficult and evasive notion of organisational knowledge.

With the IC concept, generally standing for those organisational resources that are intangible in nature and important for company's competitiveness, a number of managerial models for its disclosure and evaluation have been developed (e.g. Edvinsson & Malone, 1997; Edvinsson & Sullivan, 1996; Lev, 2001; Roos & Roos, 1997a; Roos et al., 1997b; Sveiby, 1997).

In order to assess the knowledge assets building the IC of an organisation we adopt the Knoware Tree (Schiuma et al., 2005). The Knoware Tree considers the IC as a group of knowledge assets that are attributed to an organisation and most significantly drive organisation value creation mechanisms for targeted company's key stakeholders, where a knowledge asset is any resource made of or incorporating knowledge which provides an ability to carry out a process or a function aimed to create and/or to deliver value.

The Fig. 1 depicts the categories and the main conceptual components of the Knoware Tree.

The model acknowledges that for any organisation system it is possible to distinguish two main components: its actors, both internal and external, and its structural components, i.e. all those elements at the basis of the processes. Starting from this assump-

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