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## **Network performance - What influences it?**

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# Network performance - What influences it?

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**Abstract – Purpose** - The aim of this paper is to examine the literature addressing network performance and the factors influencing it. **Design** – 29 papers published in 18 different journals were systematically reviewed through a multidimensional classification framework based on the strategy-structure-performance paradigm of strategic management. **Findings** – Based on the outputs of the literature review, a conceptual framework describing network performance is proposed. Following this framework, it is suggested that network performance is the result of the combination of network strategy, network structure and external environmental factors, and not solely the result of network structure which is characterized by five structural elements i.e. network configuration, network membership, network tie, network management and network governance. Moreover, the framework suggests that, in equal context i.e. same network strategy and same external environment, different combinations of these five structural elements lead to different network performance. **Implications** – Based on these findings, adequate network performance measurement system should include determinants at the level of the network strategy and network structure but also at the level of the external environment. **Scope for future research** – This study should be extended in order to further investigate the relationships between network strategy and network structure on the one hand and environmental factors on the other hand, but also to further investigate the network strategy, network structure and environmental factors themselves.

**Key words** – Performance, network, strategy-structure-performance paradigm

## I. INTRODUCTION AND PURPOSE

As knowledge is increasingly getting specialized and distributed across organizations, networks are now regarded as key vehicles for obtaining access to external information and resources, vital for developing innovation and hence sustainable economic growth [1]. In such

a perspective, having access to a well-performing network is considered as a crucial factor for a firm for developing innovation. However, to date, disparities remain in the levels of innovation between regions, sectors and firms. One factor which has been recognized to explain this situation concerns network performance. There is convincing evidence that some networks perform better in fostering exchange of knowledge and resources between networking firms, hence contributing to innovation, than others [2, 3]. Consequently, there is an increasing interest in network performance as a research subject [4].

The purpose of this paper is to examine the literature addressing network performance and the factors influencing it. We believe that this is the first step towards the development of an adequate network performance measurement system which would tell how the network is performing, highlight possible improvements and help to diagnose problems [5]. Understanding the factors influencing network performance would help to identify the critical aspects contributing to network success or failure, the so-called key performance indicators [6].

The paper is structured as follow. Section II presents the research design of our study. In section III, the results of our literature review are presented. Finally, section IV highlights the main issues related to our findings and identifies the missing themes and potential future research.

## II. RESEARCH DESIGN

### A. Literature review

The aim of this literature review is not to make a systematic review on what has been published on network performance; rather it aims at contributing to theory-building. In order to select the papers and to include as many

“schools” as possible, we used Web of Science and Google Scholar as search engines. We made a systematic search for articles published between 1998 and 2009 which included the term “network” or “interorganizational relationships” in the title, key words and/or abstract. Based on these criteria of selection, a total of 29 relevant articles were found in the following eighteen different journals (table 1). Most of them were published in Strategic Management Journal and in Academy Management Review.

Table 1: Journals in which the articles selected for the study are published

<i>Peer reviewed journals with impact factors</i>	<i>Peer reviewed journals without impact factors</i>
Strategic Management Journal	The Academy of Management Journal
International Journal of Management Reviews	Journal of Business Research
American Journal of Agricultural Economics	Industrial Marketing Management
British Food Journal	Entrepreneurship and Regional Development
Journal of Public Administration Research and Theory	Management Science
The Academy of Management Review	Administrative Science Quarterly
Journal of Management	
Journal of International Management	
R&D Management	
Organization Science	
British Journal of Management	

The articles selected could be categorized in three different groups depending on the research approach: quantitative approach (48% of the papers), qualitative approach (7% of the papers) and conceptual approach including literature reviews (45% of the papers). Within the empirical papers, differences could be noted in terms of country and industry (table 2). Industries included for example the car, media, food processing, steel, semi-conductor and pharmaceutical biotechnology industries.

Table 2: Scope of the empirical papers  
Note: Oceania was considered in one paper [7] which used cross-country data

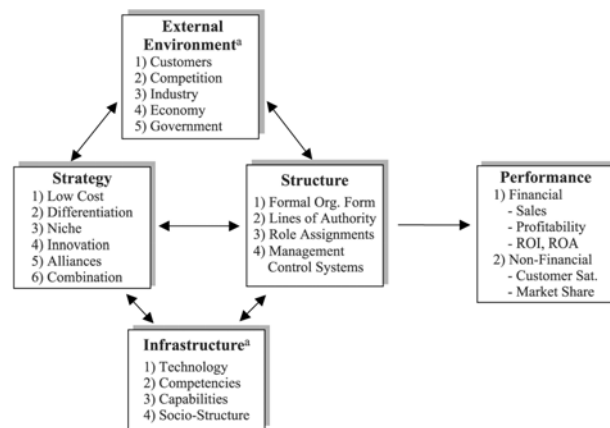
<i>Country</i>	<i>Europe</i>	<i>USA/Canada</i>	<i>Asia</i>	<i>Cross-country</i>	<i>Total</i>
<i>Industry</i>					
Mixed industry	3	4	1	1	9
Single industry	3	2	0	2	7
<i>Total</i>	6	6	1	3	16

### B. Multidimensional framework for classification of studies

Performance in general is known to be a complex concept, especially concerning its measurement. Authors in different disciplines have generally different views on what performance indicators should be included in the performance measurement system. As a consequence, there is large number of performance indicators used in literature; which usually are of different nature (i.e. qualitative vs. quantitative measures) and refer to different categories of measures (e.g. financial and operational measures) and different levels of performance (e.g. process, organization and supply chain levels) [8-10]. Moreover, of what appeared from the selected papers, network performance is influenced by many factors but the relation between these factors and network performance does not seem to be straightforward either. Network performance seems to be itself influenced by a network of interrelated and complex factors.

In order to cope with the above mentioned aspects related to performance, we used the strategy-structure-performance paradigm (SSP) of strategic management [11] as a multi-dimensional framework to classify the different papers (figure 1). The SSP paradigm was developed initially to explain the performance of a firm, but it has been extended since then to the supply chain. Since supply chains can be considered as being special networks [12], the SSP paradigm which already has been extended to the supply chain, is most probably applicable to networks as well. At the basis, the SSP paradigm predicts that a firm’s strategy, created in consideration of external and internal (i.e. infrastructure) environmental factors, drives the

development of organizational structure and processes, which in turn influence the firm's performance.



Note: <sup>a</sup>Contingent factors

Figure 1: Strategy-structure-performance paradigm [11]

Table 3: Multidimensional classification framework

Coded elements		Discussion	Measure
STRATEGY	Type of goal	Yes if it discussed in the paper No if it is not discussed	Yes if it is measured in the paper No, if it is not measured
	Goal level:	If yes,	If yes,
	- Firm level (F) - Dyadic level (D) - Network level (N)	- type of goals discussed - three possible codes (i.e. F, D, N) depending on the level considered	- type of goals measured - three possible codes (i.e. F, D, N) depending on the level considered
STRUCTURE		Yes if it discussed No if it is not discussed	Yes if it is measured No, if it is not measured
		If yes,	If yes,
		- type of structural elements discussed	- type of structural elements measured
PERFORMANCE	Goal based	Yes/G if performance is discussed in consideration of goals	Yes/G if performance is measured in consideration of goals
	Type of goal	Yes/NG if it is discussed but not in consideration of goals	Yes/NG if it is measured but not in consideration of goals
	Goal level:	No if it is not discussed	No, if it is not measured
	- Firm level	If yes/G,	If yes/G,
	- Dyadic level	- type of goals discussed	- type of goals discussed
	- Network level	- three possible codes depending on the level considered	- three possible codes depending on the level considered
CONTINGENT FACTORS (CF)		Yes if it discussed No if it is not discussed	Yes if it is measured No, if it is not measured
		If yes,	If yes,
		- type of contingent factors	- type of contingent factors
LINK BETWEEN CF & STRATEGY		Yes if it discussed	Yes if it is measured
LINK BETWEEN STRATEGY & STRUCTURE		No if it is not discussed	No, if it is not measured
LINK BETWEEN CF & STRUCTURE		If yes,	If yes,
LINK BETWEEN STRUCTURE AND PERFORMANCE		- nature of the link	- nature of the link

The second dimension refers to the structure component of the framework. Adapted from the definition of organizational structure from Dalton, Todor et al. [15] *network structure can*

Based on this framework, we analyzed the papers following eight dimensions (table 3). First, as the focus of strategy are goals establishment and policies and plans development to achieve these goals [13, 14], the papers were analyzed in relation to the consideration (or not) of goals and, where considered, regarding the type of goals e.g. innovation. As we assume that goals that are set in a network can either refer to firms' goals, to goals of a dyad, or to goals of the network as a whole, we also distinguished between the papers depending on which goal level they relate to.

*be seen as the anatomy of the network providing a foundation within which the network functions.* Based on this definition, the papers were classified depending on whether the network

structure was considered (or not), and in case it was, the papers were classified based on the type of structural elements under study.

The third dimension based on which we classified the papers refers to network performance. Due to the wide variety of performance measures used in literature and the lack of clear and non-overlapping performance measures categories [4, 5, 8, 16], we chose, based on the premise that performance is defined as the level of achievement of goals [17], to classify the papers based on whether goals with regard to performance were taken into account (or not) and on the type of goals. Furthermore, similarly to the strategy dimension of the framework, we distinguished the papers based on the level at which the performance was studied i.e. firm, dyadic, and network levels.

The fourth dimension relates to the contingent or environmental factors. Papers were classified depending on whether external and internal environmental factors were considered or not, and if they were, on the type of contingent factors considered.

The last four dimensions are used to classify the papers in this study related to the relationships, if any, between the different components of the framework. The fifth relational dimension refers to the relationship established between the contingent factors and the strategy; the sixth to the relationship established between the strategy and the network structure; the seventh to the relationship established between the contingent factors and the network structure; while the eighth and final dimension refers to the relationship established between the network structure and performance. The aim of classifying the papers based on these four relational dimensions is to determine what components so far have been recognized in literature to influence network performance.

Regarding all dimensions, papers were further classified based on whether the dimension considered was discussed or measured as the selected papers usually presented discrepancy in this regard. Table 3 summarizes the multidimensional classification framework used in this study.

### III. ANALYSIS

#### A. *Discussing and measuring network strategy*

Around one third of the papers (10) discuss to a certain extent goals but none of the papers measure goals. Amongst the papers where goals are discussed, 6 refer to the firm's goals exclusively [3, 12, 18-21], 2 to network's goals [22, 23], 2 to both firm's goals and network's goals [24, 25] and 1 to firm's-, network's- and individual goals i.e. goals of each person involved in the collaboration [26].

Although none of the papers have goals as direct focus, hence goals are not discussed extensively; there are nevertheless different types of goals or at least different types of competitive strategies which are referred to. Firstly, concerning goals at the firm level, it is stated in Goerzen and Beamish [20] that it is widely recognized that the ultimate goals firms seek to reach are of an economic nature. In another word, firms seek to make profit. To make profit, firms try to increase their competitiveness via different competitive strategies. Based on the papers, some firms develop an innovation strategy which can be of three types. First, firms can follow a *prospector or explorer strategy* and focus on searching and experimenting to find innovations that will produce future profits [18, 19, 21]. Second, they can develop a *defender or exploiter strategy* and are focus on searching for and exploiting existing technologies, skills and information [3, 19, 21]. Third, firms can opt for an *analyzer strategy*, situated somewhat in between the explorer and defender strategies [21]. In addition, in Pittaway, Robertson et al. [3], a "power strategy" is also mentioned as being used by firms looking for power over its suppliers or buyers for example. Secondly, there are a few network goals which are mentioned in the articles. In the public sector, network goals might for example include developing new clients, attracting network-funding, addressing community needs or improved client service [24] while in a supply chain network context, they might include differentiation, integrated quality and cost reduction [25].

From reviewing the articles, it appears that an extra dimension related to the alignment of goals could be used to classify the papers. Four out of the 10 articles where goals are mentioned discuss goal consensus, shared goals or alignment of network-, firm- and (in some cases) individual level goals [22-24, 26].

### B. *Discussing and measuring network structure*

Overall, the network structure is discussed in 40% of the papers and measured (to a certain extent) in 60% of the papers. Several structural elements are sometimes considered in the same paper, some of which are discussed and others measured. Based on the extension of the concepts of “structural” and “structuring” characteristics of organization of Campbell et al. to the network [15], we classified the structural elements into two groups. The network structural elements were classified as either elements of the *structural dimension of network* referring to the physical characteristics of the network or as elements of the *structuring dimension of network* relating to the policies and activities occurring within the network that prescribe or restrict the behavior of network members (table 4).

Based on the selected papers, there are three broad types of structural elements related to the structural dimension of network: network configuration, network membership and network ties. These are discussed in the subsequent paragraphs.

#### *Network configuration*

Network configuration relates to the pattern of linkages among network members. There are four components of network configuration which are discussed and/or measured in the papers. The first component, referring to the weak connectedness between the network members of a firm, is *network sparseness* which is also known as the structural hole form of social capital. It is discussed in 5 papers [3, 23, 25, 27, 28] and measured in 5 papers [19, 21, 29-31]. The second component of network configuration is *network density* (also known as network closure or closure form of social capital) which refers, in contrast to network

sparseness, to the high connectedness between the network members of a firm. Eight papers discuss network density to a certain extent [3, 12, 23, 25, 27, 28, 32, 33] while 3 measure it [19, 30, 31]. The third component of network configuration concerns the *pattern of direct and indirect ties*. Direct ties are ties that an organization has with its network partners while indirect ties are ties that an organization has with the partners of its network partners. Patterns of direct and indirect ties are discussed in Gulati, Nohria et al. [28] and measured in Beckman and Haunschild [34]. The fourth and final component of network configuration is *centrality* which refers to the extent to which a network revolves around one single firm in the network. Centrality is discussed in 8 articles [3, 12, 23, 26, 28, 29, 33] and measured in 2 [21, 35].

#### *Network membership*

Network membership, referring to the composition of the network, is considered in the selected articles in terms of two components. First, network membership is discussed in 3 articles [22, 24, 36] and measured in 2 articles [20, 37] in terms of the *number of network members*. Second, it is discussed and/or measured in terms of the *type of network members* which relates to the size [34], industry [20, 28, 34], scope of activities e.g. suppliers, customers [3, 28], resources [28, 38], past experiences and knowledge [29, 34], geographical situation [22, 28] and innovativeness [30].

#### *Network tie*

Network tie refer to the characteristics of the relationships between network members. There are two components which have been discussed and/or measured in the articles. First, authors have been interested in the *strength of ties* which refers, following Granovetter [39], to the amount of time, emotional intensity, intimacy and reciprocal services which characterize the tie. Weak ties characterized by a low frequency and intensity of interactions are discussed in 5 papers [2, 3, 23, 28, 40] and measured in Rowley, Behrens et al. [19]. Strong ties differentiated by a high frequency and intensity of interactions embedded of trust are also discussed in 5 papers [2, 23, 27, 28, 40] and measured in Rowley, Behrens et al. [19]. The second component of

network tie investigated by certain authors is *network multiplexity* which refers to the multiple relationships a firm develops with the same network member. Network multiplexity is to the structuring dimension of network: network management and network governance. These are discussed in the following paragraphs.

measured in Beckman and Haunschild [34]. Besides the structural dimension of network, papers investigate two different elements related

Table 4: Network structure in the selected papers

Notes: FNG mechanisms, formal network governance mechanisms, ING mechanism, informal network governance mechanisms

<i>Network dimension</i>	<i>Type of structural elements</i>	<i>Papers including only the discussed scope</i>	<i>Papers including the measured scope</i>	<i>Number of papers</i>
STRUCTURAL	Network configuration			
	<i>Network sparseness</i>	Sporleder & Moss, 2002; van der Vorst, 2006; Pittaway et al, 2004; Gulati et al, 2000; Inkpen & Tsang, 2005	Rodan & Galunic, 2004; Rowley et al, 2000; Zaheer & Bell, 2005; Soda et al, 2004; Koka & Prescott, 2008	10
	<i>Network density</i>	Borgatti & Foster, 2003; Omta, 2002; Hagerdoon et al, 2006; Sporleder & Moss, 2002; van der Vorst, 2006; Pittaway et al, 2004; Gulati et al, 2000; Inkpen & Tsang, 2005	Rowley et al, 2000; Zaheer & Bell, 2005; Soda et al, 2004	11
	<i>Pattern of direct and indirect ties</i>	Gulati et al, 2000	Beckman & Haunschild, 2002	2
	<i>Centrality</i>	Pittaway et al, 2004; Pitsis et al, 2004 ; Omta, 2002 ; Hagerdoon et al, 2006 ; Inkpen & Tsang, 2005 ; Rodan & Galunic, 2004; Gulati et al, 2000	Tsai, 2001; Koka & Prescott, 2008	9
	Network membership			
	<i>Number of network members</i>	Provan & Kenis, 2007; Huggins, 2000; Wincent et al, 2009	Goerzen & Beamish, 2005	4
	<i>Type of network members:</i>			
	- <i>Size</i>		Beckman & Haunschild, 2002	1
	- <i>Industry</i>	Beckman & Haunschildt, 2002; Gulati et al, 2000	Goerzen & Beamish, 2005	3
	- <i>Scope of activities</i>	Pittaway et al, 2004; Gulati et al, 2000		2
	- <i>Resources</i>	Gulati et al, 2000; Dyer and Singh, 1998		1
	- <i>Past experience and knowledge</i>	Rodan & Galunic, 2004; Beckman & Haunschildt, 2002		2
	- <i>Geographical situation</i>	Gulati et al, 2000; Huggins, 2000		
	- <i>Innovativeness</i>		Zaheer and Bell, 2005	1
STRUCTURING	Network tie			
	<i>Strength of ties:</i>			
	- <i>Weak ties</i>	Pittaway et al, 2004; Gulati et al, 2000 ; Thorpe et al, 2005; Dyer & Nobeoka, 2000 ; Inkpen & Tsang, 2005	Rowley et al, 2000	6
	- <i>Strong ties</i>	Sporleder & Moss, 2002; Gulati et al, 2000; Thorpe et al, 2005; Dyer & Nobeoka, 2000; Inkpen & Tsang, 2005	Rowley et al, 2000	6
	<i>Network multiplexity</i>		Beckman & Haunschild, 2002	1
	Network management			
	<i>Conflict management</i>		Kale et al, 2000	1
	<i>Developing shared goals</i>	Huggins, 2000; Pitsis et al, 2004; Inkpen and Tsang, 2005; Provan and Kenis, 2007; van der Vorst, 2006		4
	<i>Developing a network culture</i>	Pitsis et al, 2004; Inkpen and Tsang, 2005; Dyer and Singh, 1998		3
	Network governance			
	<i>Network board</i>	Provan and Kennis, 2007	Wincent et al, 2009	2
	<i>FNG mechanisms</i>	Pittaway et al, 2004; Gulati et al, 2000; Kale et al, 2000; Pitsis et al, 2004; Omta, 2002; Dyer and Singh, 1998		6
	<i>ING mechanisms:</i>			
	- <i>Reputation</i>	Dyer and Singh, 1998; Gulati, Nohria et		4



### Network management

Network management refers to the managerial and behavioral components that facilitate the execution of joint action across the whole network. Three components of network management are considered in the papers. The first refers to *conflict management*, i.e. the way conflicts between the network members are dealt with, and is measured in Kale, Singh et al. [41]. The second component of network management relates to the *development of shared goals*, goal consensus or to the alignment of network-, firm- and (in some cases) individual level goals for network success. It is discussed in 5 papers [22-26]. Finally, the third component refers to the *development of a network culture* and is discussed in Pitsis, Kornberger et al. [26] and Inkpen and Tsang [23]. It should be mentioned that there is a fourth component of network management which is discussed in the selected papers and which concerns *building relational capital*. We decided to classify this component in the section concerning network governance as relational capital relates to informal governance mechanisms in most of the articles.

### Network governance

Network governance or tie modality involves the use of institutions and structures of authority and collaboration to direct, administrate, and control joint action across the whole network. There are three network governance components which are considered in the papers. The first component is *network board* defined by Wincent, Anokhin et al. [36] as “a group of individuals with supervisory power to make important decisions on major issues”. Network board is discussed in Provan and Kenis [24] in terms of network board composition and independence i.e. network governed by the members themselves, by a single participating members or by outsiders. In Wincent, Anokhin et al. [36], network board is measured in terms of board continuity relating to the rate at which board members are replaced, board size, board age, frequency of board meetings, board competence diversity and board independence.

The second component of network governance discussed and/or measured in the papers relates to *formal network governance mechanisms*. These, discussed in 6 papers, mainly refer to the use of contractual arrangements (i.e. third-party enforcement of agreements) and equity arrangements or financial hostage (i.e. self-enforcing agreements) [3, 12, 26, 28, 38, 41]. Lastly, the third component of network governance considered by the authors refers to *informal network governance mechanisms*. These principally relate to reputation which is discussed in 4 papers [19, 28, 38, 41] but also to relational capital (or social capital) which can be understood for the most part as the mutual trust that resides at the individual level between network partners. Relational capital or trust is discussed in 8 articles [2, 3, 12, 22, 25, 26, 28, 38] and measured in 1 [41].

### C. Discussing and measuring performance

Performance is discussed in consideration of goals in one paper [25] and measured in two [18, 20] (table 5). In van der Vorst [25], the focus is on the performance at the network level and both network and firm level goals are considered. It is stated that performance should be measured based on a number of performance metrics which take first into account the network objectives and second the objectives of each network member. In Fortuin and Omta [18] and Goerzen and Beamish [20], the focus is on the performance at the firm level and only the firm level goals are taken into account. These relate to innovation [18] and profit [18, 20]; hence in these articles performance refers either to innovation and/or economical performance.

Besides the papers where there is clear link between performance and goals, there are a number of papers dealing with performance but not in consideration of goals (table 5). Most of these papers (11 out of 18) focus on the performance at the firm level [2, 3, 19, 21, 27, 28, 30, 34, 36, 37, 41] while five focus on the

performance at the network level [22, 24, 26, 31, 38] and none on the performance at the dyad level. Interestingly, two papers investigate performance at levels others than the ones which have been considered in our framework: the intraorganizational business unit and individual levels [29, 35]. It should be mentioned that the

article of Soda, Usai et al. [31] do not explicitly refer to performance at the network level. Nevertheless, we decided to classify it in the network level category as it focuses on the performance of TV productions which are the results of a number of specialists working together.

Table 5: Performance in the selected papers

Note: Intraorg. BU, intraorganizational business unit

<i>Performance level measurement</i>	<i>Performance type</i>	<i>Papers including only the discussed scope</i>		<i>Papers including the measured scope</i>		<i>Number of papers</i>
		<i>Yes/G</i>	<i>Yes/NG</i>	<i>Yes/G</i>	<i>Yes/NG</i>	
Network	Economical performance	van der Vorst, 2006				1
	Innovation performance					
	Learning performance					
	Managerial performance					
	Success/failure		Huggins, 2000			1
Dyadic	Effectiveness		Provan & Kenis, 2007; Dyer & Singh, 1998; Pitsis et al., 2004			3
	Others			Soda et al, 2004		1
	Economical performance					
	Innovation performance					
	Learning performance					
Firm	Managerial performance					
	Success/failure					
	Effectiveness					
	Other					
	Economical performance		Sporleder and Moss, 2002; Gulati et al., 2000	Goerzen and Beamish, 2005; Fortuin & Omta, 2009	Rowley et al., 2000; Zaheer & Bell, 2005; Koka and Prescott, 2008	7
Intraorg. BU	Innovation performance		Pittaway et al, 2004	Fortuin & Omta, 2009	Wincent et al, 2009; Ritter & Gemünden, 2003	4
	Learning performance				Beckman & Haunschild, 2002; Dyer & Nobeoka, 2000; Kale et al, 2000	3
	Managerial performance					
	Success/failure					
	Effectiveness					
Individual	Others					
	Economical performance				Tsai, 2001	1
	Innovation performance				Tsai, 2001	1
	Learning performance					
	Managerial performance					
Individual	Success/failure					
	Effectiveness					
	Others					
	Economical performance				Rodan and Galunic, 2004	1
	Innovation performance					
Individual	Learning performance					
	Managerial performance					
	Success/failure				Rodan and Galunic, 2004	1
	Effectiveness					
	Others					

In the 18 papers dealing with performance but not in consideration of goals, performance is of seven different types. The most common types are *economical performance*, *innovation performance* and *learning performance*. Besides these, some articles discuss performance in terms of *success and failure* of networks which refer to the ability of networks to become a sustained and valued form of business activity for their members [22]; others in terms of network *effectiveness* which relates to the attainment of outcomes which could not have normally been achieved by network member acting independently; while still some other articles discuss performance in terms of *managerial performance*. In addition to these types of performance, there is still another type of performance which we classify under “*others*”, being rather particular and specific to

the sector under investigation. This refers to the TV productions performance in Soda, Usai et al. [31] which was measured *via* the size of the audience.

#### D. Discussing and measuring contingent factors

As mentioned in the SSP paradigm, contingent factors refer either to internal environmental factors (or infrastructure) or to external factors. These will be discussed one after another in the next paragraphs.

##### Internal environmental factors

In the selected papers, there are eight internal environmental factors which are discussed and/or measured (table 6).

Table 6: Internal environmental factors in selected papers

Type of internal environmental factor	Papers including only the discussed scope	Papers including the measured scope	Number of papers
Networking capability	Möller and Halinen, 1999; Goerzen and Beamish, 2005; Gulati et al, 2000; Kale et al, 2000; Ritter et al, 2004	Ritter & Gemünden, 2003; Hagerdoon et al, 2006	7
Innovation capability		Fortuin & Omta, 2009; Zaheer & Bell, 2005; Tsai, 2001	3
Network visioning capability	Möller and Halinen, 1999		1
Net management capability	Möller and Halinen, 1999		1
Level of technical and commercial competence	Pittaway et al, 2004		1
Firm resources		Fortuin & Omta, 2009	1
Organizational culture	Goerzen & Beamish, 2005; Pitsis et al, 2004; Omta, 2002		3
Network experiential knowledge		Blomstermo et al, 2004	1

The first, discussed in 5 papers [20, 28, 41-43] and measured in 2 [33, 37], is *networking capability* also known as relationship management capability, alliance capability or network competence. It refers to the firm's competence in handling relationships and is influenced, following Ritter and Gemünden [37], by four organizational antecedents i.e. access to resources, network orientation of human resources, integration of company's communication structure and openness of corporate culture. Some authors go further in defining the concept of networking capability by breaking it up in different components. In Ritter and Gemünden [37], it is seen as a two-dimensional construct and includes network management task execution and network

management qualifications. In Hagerdoon, Roijakkers et al. [33], a distinction is made between general network capabilities which relate to the experiences with networking and specific network capabilities which relate to the degree to which a firm has learned to place itself in a particular position in a network. The second internal environmental factor is *innovation capability* which refers to the capacity of a firm to innovate and which is measured in 3 papers. Depending on the papers, innovation capability either refer to management of innovation, cross-functional and external communication [18], innovativeness [30] or absorptive capacity [35]. The third and fourth internal environmental factors are *network visioning capability* and *net visioning capability*. Network visioning

capability is defined in Möller and Halinen [42] as the “*management skills and competencies in creating valid views of networks and their potential evolution*” and net visioning capability as the “*firm’s capability to mobilize and coordinate resources and activities of other actors in the network*”. The fifth internal environmental factor relates to the *level of technical and commercial competence* and is discussed in Pittaway, Robertson et al. [3]; while the sixth, measured in Fortuin and Omta [18], concerns the firm resources. The seventh internal environmental factor, discussed in three papers [12, 20, 26], is *organizational culture* which refers to corporate identity. Finally, the eighth internal environmental factor is *network experiential knowledge*, measured in Blomstermo, Erikson et al. [7] and defined as the “*firm’s knowledge of the local network of business relationships in a market*”.

#### *External environmental factors*

There are three external environmental factors discussed and/or measured in the

selected papers (table 7). The first is the *competitive environment* which is discussed in 4 papers [12, 19, 21, 27] and measured in 1 [18]. The major focus of the authors regarding competitive environment is its unpredictability or uncertainty [e.g. 19] and its turbulence [e.g. 21]. Fortuin and Omta [18] also consider, when looking at the competitive environment, the imbalance of bargaining power between suppliers and buyers. The second external environmental factor is the *institutional and policy environment* which is discussed in 3 papers [3, 38, 40]. It includes the legal system, banking and finance system, structure of the labor market and the education and political systems. The third and last external environmental factor considered in the selected paper is the *social environment* which refers essentially to the national culture e.g. entrepreneurial, collectivist or individualist cultures. It is discussed in Thorpe, Holt et al. [40] and Goerzen and Beamish [20].

Table 7: External environmental factors in selected papers

<i>Type of external environmental factor</i>	<i>Papers including only the discussed scope</i>	<i>Papers including the measured scope</i>	<i>Number of papers</i>
Competitive environment	Sporleder & Moss, 2002; Rowley et al, 2000; Koka & Prescott, 2008; Omta, 2002	Fortuin & Omta, 2009	5
Institutional and policy environment	Pittaway et al, 2004; Thorpe et al, 2005 ; Dyer and Singh, 1998		3
Social environment	Goerzen and Beamish, 2005; Thorpe et al., 2005		1

#### *E. Discussing the links between the components of SSP paradigm*

##### *Link between contingent factors and strategy*

Three papers discuss the link between contingent factors and strategy [19, 21, 27], but only the uncertainty related characteristic of the *competitive environment*, the strategy at the firm level and the innovation strategy (i.e. exploiter vs. explorer or defender vs. analyzer strategies) are considered. Following these papers, the choice of a firm to opt for a certain innovation strategy depends on the conditions of the environment, and especially on its uncertainty. Following e.g. Rowley, Behrens et al. [19], a firm in a stable environment will more develop an exploiter innovation strategy while in an

unstable environment, the same firm will more choose for an explorer innovation strategy.

No papers measure the link between contingent factors and strategy.

##### *Link between strategy and structure*

There are 5 papers which discuss the link between strategy and structure, some of which establishing a link between strategy and the structural dimension of network [3, 19, 21, 27] while others with the structuring dimension of network [25]. Regarding the papers relating to the structural dimension of network, the focus is on *network configuration*, *strength of ties* and *network membership* and on two types of competitive strategies, i.e. *innovation* and “*power*” *strategy*, whereas, regarding the paper relating to the structuring dimension, the focus is on network management. All papers except van

der Vorst [25] centre their attention on the strategy at the firm level; in van der Vorst [25], the focus is on the strategy at the network level. Based on the papers, network configuration, strength of ties, and network membership is contingent on the firm strategy. Following e.g. Rowley, Behrens et al. [19] where innovation strategies are discussed, a firm having an exploiter strategy, and therefore interested in gaining specific know-how, will prefer a dense network over a sparse one. On the contrary, a firm having an explorer strategy will prefer a sparse network in order to have access to new and non-overlapping information. Moreover, in the context of a firm having an innovation strategy, the network configuration depends also, following Pittaway, Robertson et al. [3], on the type of innovation required, i.e. process vs. product innovation, while the type of network members is contingent on whether the firm seeks to develop incremental or radical innovation. In case of a firm having a “power strategy”, it will seek for centrality in order to gain power over network members [3]. Besides, following van der Vorst [25], network management is directly related to the objectives of the network. It should be mentioned that none of the selected papers measure the link between strategy and structure.

#### *Link between contingent factors and structure*

There are a few papers which discuss and/or measure the link between contingent factors and structure. We will first review the papers where internal environmental factors are considered and then papers where external factors are considered. It should be mentioned that the focus in the articles is not the network structure per se but more the development of relationships between firms; hence the points discussed here could also have fitted in the section on the link between contingent factors and strategy as the degree to which relationships are developed between firms can be seen as being part of the networking strategy of the firm.

Internal factors: There is 1 paper which discusses the link between internal environmental factors and structure [3] and 2 which measure this link [33, 37]. In these papers, there are two internal environmental

factors which are considered. In Pittaway, Robertson et al. [3], the focus is on the *level of technical and commercial competence*. Following this article, a high level of technical and commercial competence is required to attract partners, but, at the same time, a high level of technical and commercial competence hold firms to engage in networking, these being less likely to see the value of forming networks. In Ritter and Gemünden [37] and Hagedoorn, Roijakkers et al. [33], the focus is on *networking capability*. Following both articles, the level of networking capability of a firm determines the degree to which it develops relationships with other firms. In Ritter and Gemünden [37], as already mentioned before, network capability is broken down into network management task execution (i.e. degree to which tasks relevant to manage a single relationship and tasks relevant to manage a portfolios of relationships or network are used) and network management qualifications (i.e. various types of qualifications required to effectively manage a network). Following the article, there is a strong link between both components and the number of network partners of a firm. In Hagedoorn, Roijakkers et al. [33], networking capability is analyzed through general network capability (i.e. role of experience with networking through the number of relationships in which a firm is involved), specific efficiency-based strategic network capability (i.e. extent to which a firm has learned to optimize its number of partnerships within a group of firms) and specific centrality-based strategic network capability (i.e. extent to which a firm has learned to position itself centrally in a network). Based on the article, only the last two components of networking capability are positively and significantly linked to the likelihood of a firm to develop relationships.

External factors: Two papers [3, 40] discuss the link between external environmental factors and structure, but none measure it. The focus in Pittaway, Robertson et al. [3] and in Thorpe, Holt et al. [40] is on the *institutional and policy environment*. Following the articles, the institutional and policy environment plays a role in facilitating the development of networks. Governments can shape the cultural conditions and infrastructure for networking but also can

assist in brokering relationships and acting as intermediaries. Moreover, the institutional and policy environment also plays a role in shaping network configurations as it influences inclinations towards trust, legal contracting, opportunism and self-interests. It should be mentioned that, although not stated explicitly in any of the articles, the imbalance of power between suppliers and buyers (i.e. high pressure of buyers over suppliers), because recognized as a driver for innovation [18], could push suppliers to network with other firms in order to innovate.

#### *Link between structure and performance*

Several papers discuss and/or measure the link between structure and performance. In the following paragraphs, we will examine one after another each of the network structural elements presented in table 4, i.e. network configuration, network membership, network tie, network management and network governance. It should be mentioned that for the majority of the components of network structure, no general conclusion concerning the nature of the link will be drawn. Comparing the results of different articles on one particular component is, in most cases, not appropriate, and this for two main reasons. First, articles might measure performance at different level e.g. network and firm level. Second, they might refer to different types of performance e.g. economical and learning performance.

*Network configuration:* There are 2 papers where the link between network configuration and performance is discussed [27, 28] and 6 where the link is measured [19, 21, 29-31, 35], covering together the four different components of network configuration described in section III.B i.e. *network sparseness, network density, pattern of direct and indirect ties and centrality* (table 8). It should be mentioned that Sporleder

and Moss [27] mainly refer to the results of Rowley et al. [19] when they discuss network sparseness/network density and performance. Following the articles, there is no optimal network configuration; rather the benefits of a certain type of network configuration vary in function of the situation. The impact of one type of network configuration on performance seems to first depend on the type of performance under investigation. As an example, a business unit's centrality in its intraorganizational network is recognized in Tsai [35] as positively and significantly influencing innovation performance while it does not have any impact on the economical performance of the business unit. Second, the benefits of a certain network configuration on performance might be triggered by environmental changes. In e.g. Koka et al. [21], it is shown that, following a legislative change, a firm centrally positioned in a network will exhibit lower economical performance while a firm occupying a bridging position in a sparse network higher economical performance. Third and last, it is not solely a particular network configuration which influences performance but rather a combination of this particular network configuration with a certain network strategy and/or other network characteristics such as network membership. As a first example, it is recognized in Koka et al. [21] that a firm pursuing an analyzer strategy and a central position within the network will exhibit higher relative performance than firms pursuing a defender strategy. As a second example, Rodan and Galunic [29] show that a sparse network will positively be linked to innovation performance if it is combined with a high level of knowledge heterogeneity within the network members.

Table 8: Link between structure and performance

Notes: FNG mechanisms, formal network governance mechanisms, ING mechanism, informal network governance mechanisms

Type of structural elements	Aspect discussed	Papers including only the discussed scope				Papers including the measured scope			
		-	0	+	Context dependent	-	0	+	Context dependent
Network configuration <i>Network sparseness</i>				Gulati et al., 2000	Sporleder & Moss, 2002			Rodan & Galunic, 2004; Zaheer & Bell, 2005	Rowley et al., 2000; Koka & Prescott, 2008; Soda et al, 2004
<i>Network density</i>					Sporleder & Moss, 2002		Zaheer & Bell, 2005		Rowley et al, 2000; Soda et al, 2004
<i>Pattern of direct and indirect ties</i>				Gulati et al., 2000					
<i>Centrality</i>	Central position			Gulati et al., 2000			Tsai, 2001		Koka & Prescott, 2008
Network membership <i>Number of network members</i> <i>Type of network members</i>	High number Diversity  Proximity Complementarity Innovativeness	Gulati et al., 2000		Pittaway et al., 2004   Dyer & Singh, 1998		Huggins, 2000 Huggins, 2000		Ritter & Gemünden, 2003 Rodan & Galunic, 2004; Beckman & Haunschildt, 2002 Huggins, 2000	Goerzen and Beamish, 2005
Network tie <i>Strength of ties</i> <i>Network multiplexity</i>	Strong ties			Gulati et al., 2000				Dyer & Nobeoka, 2000 Beckman & Haunschild, 2002	Rowley et al., 2000
Network management	Conflict management Incentives to encourage transparency and discourage free riding  Capability of broker/leader			Dyer and Singh, 1998  Huggins, 2000; Pitsis et al, 2004				Kale et al, 2000	
Network governance <i>Network board</i>          <i>FNG mechanisms</i> <i>ING mechanisms</i>	Network board continuity Large board  Board competence diversity High frequency of meetings Board independence	Dyer & Singh, 1998		Provan & Kenis, 2007  Dyer & Singh, 1998; Pitsis et al, 2004 ; Huggins, 2000		Wincent et al, 2009  Wincent et al, 2009		Wincent et al, 2009  Wincent et al, 2009  Kale et al, 2000	Wincent et al, 2009

Network membership: There are 7 articles dealing with the link between network membership and performance (table 8); 4 of which discussing this link [3, 22, 28, 38] while 3 measuring it [20, 29, 34]. Both components of network membership of table 4, i.e. *number of network members* and *type of network members*, are considered in the articles (table 8). It should be mentioned that articles discuss the type of network members in terms of four aspects: diversity (i.e. how diverse network members are in terms e.g. of knowledge and type of industry covered), proximity (i.e. how geographically close are network members), complementarity (i.e. how complementary network members are in terms of e.g. resources and capabilities), and innovativeness (i.e. how innovative are network members). Following the articles, the aspect of network membership which has received the most attention is network diversity. Depending on the article, network diversity is discussed either in terms of diversity of scope of activities of network members [3], diversity of the nature of the businesses involved [22], number of unique relationships with the focal firm and number of unique industries of partners [20], past experiences (including good/bad and small/big experiences), patterns of direct and indirect ties and network members' size [34], and heterogeneity of knowledge [29]. It is interesting to notice that in the articles concerned with innovation and/or learning performance [3, 29, 34], support is given to the idea that there is a positive link between network diversity and performance while the articles focusing on economical performance and/or network success and failure do not support such a link [20, 22]. They instead provide evidence that firms maintaining a homogenous network enjoy superior performance than firms maintaining a heterogeneous network. Regarding economical performance, network diversity seems only to become beneficial for firms beyond a certain point i.e. when firms develop a highly heterogeneous network instead of "an average heterogeneous" network [20]. It should be mentioned that diverging results are also obtained for the nature of the link between the number of network members and performance depending on the type of performance considered. In Huggins [22], where

the focus is on the success and failure of networks, it is concluded that the higher the number of network members the poorer the performance while in Ritter and Gemünden [37], where the focus is on innovation performance, it is concluded the opposite.

#### Network tie:

The link between network tie and performance is discussed in 1 paper [28] and measured in 3 [2, 19, 34]. It should be mentioned that Gulati, Nohria et al. [28] mainly refers to Dyer and Nobeoka [2] when they discuss the strength of ties. Both components of network tie, i.e. *network strength* and *network multiplexity*, are considered in the papers, network strength being the one the most studied in the articles (table 8). Following the articles, strength of ties has especially received attention in the context of learning and the benefits of strong/weak ties seem to be contingent on the environment. Strong ties, associated with trust and fine-grained information exchange between partners, lead to higher economical and learning performance than weak ties in stable environments where an exploitation strategy is used [2, 19]. On the contrary, weak ties, through which novel information are accessible, lead to higher economical performance than strong ties in uncertain environments where an exploration strategy is used [19].

#### Network management:

There are 4 articles which discuss [22, 26, 38] and measure [41] the link between network management and performance (table 8). Three aspects are considered in the articles i.e. *conflict management*, incentives to encourage transparency and discourage free riding and capability of broker/leader; hence only one of the component of network management is explicitly considered. It should be pointed out however that the other components of network management i.e. developing shared goals and network culture are considered through the capability of broker/leader. E.g. Huggins [22] emphasizes the importance of the role of the broker in harnessing the different interests and attitudes of network members in a format that generates valid interaction, hence contributing to success of the network as a whole. It should be mentioned that in Huggins [22], the importance



of the role of the broker in conflict management is also emphasized.

#### Network governance:

The link between network governance and performance is discussed in 4 articles [22, 24, 26, 38] and measured in 2 [36, 41]. All three components of network governance, i.e. *network board*, *formal network governance mechanisms* and *informal network governance mechanisms*, are considered (table 8). There are two points worth noticing concerning the link between network governance and performance. The first concerns board independence. Wincent, Anokhin et al. [36] support the idea that board independence is negatively related to performance while Provan and Kenis [24] have a more moderate idea about the relationship between board independence and performance and suggest that the impact of board independence on performance is contingent on the level of trust between network members, the number of network members, the degree of goal consensus and the need for network-level competencies. The second point concerns network governance mechanisms. It seems that, whether performance refers to economical, learning or other types of performance, there is a consensus among authors that informal network governance mechanisms, especially relational capital, lead to higher performance than formal network governance mechanisms.

## IV. CONCLUSION

The aim of this paper was to examine the literature addressing network performance and the factors influencing it. Based on the outcomes of the review of the papers, we adapted the SSP paradigm to develop a conceptual framework on network performance (figure 2) which we define, based on Huggins [22], as the extent to which network becomes a valued form of business for network members.

Similarly to the SSP paradigm, our framework on network performance suggests first that network strategy is influenced by external and internal environmental factors. In the selected papers, the link between strategy and environmental factors was especially

recognized with one external environmental factor i.e. the competitive environment [19, 21, 27]. Hence, in the context of future research, it would be interesting to investigate the potential links between network strategy and some of the other external and environmental factors identified in this study such as the social environment and organizational culture. Second, our framework supports the idea that in the network context, structure is influenced by external and internal environmental factors, like it was the case in the firm context. We recommend however to investigate further this link in future research as the focus of the relevant papers was not on network structure per se, but more on the extent to which relationships were developed between firms [e.g. 33, 37, 40]. Third, like in the SSP paradigm, network structure is recognized in our framework to be influenced by network strategy. In the selected papers, the relationship between the structural dimension of network and network strategy was especially discussed [e.g. 3, 19, 25, 27].

In contrast to the SSP paradigm, our framework proposes that network performance is the result of the combination of network strategy, network structure and external environment, and not solely the result of network structure like it is suggested in the SSP paradigm. This was supported in different articles such as Koka & Prescott [21] and Rowley, Behrens et al. [19] where it was shown that a particular network configuration had a positive impact on performance if combined with a certain network strategy and/or particular environment. Moreover, regarding the network structure, our framework suggests that, in an equal context, i.e. same network strategy and same external environment, different combinations of network structural elements lead to different network performance. As an example, Rodan and Galunic [29] showed that a sparse network will positively be linked to innovation performance if it is combined with a high level of knowledge heterogeneity within the network members.

The findings of this study have important implications for the development of network performance measurement systems. They suggest that an adequate network performance measurement system should include

determinants at the level of the network strategy and network structure but also at the level of the external environment. Determinants at the level of network structure would relate to network configuration, network membership, network tie, network management and network governance and their different components. It should be mentioned that we deliberately chose to only detail the network structure in our framework as

the extent to which the other components (i.e. network strategy and external and internal environmental factors) were investigated was rather limited in the papers. Hence, in the context of future research, we recommend to extend the study in order to identify determinants of performance at the level of the network strategy and external environment.

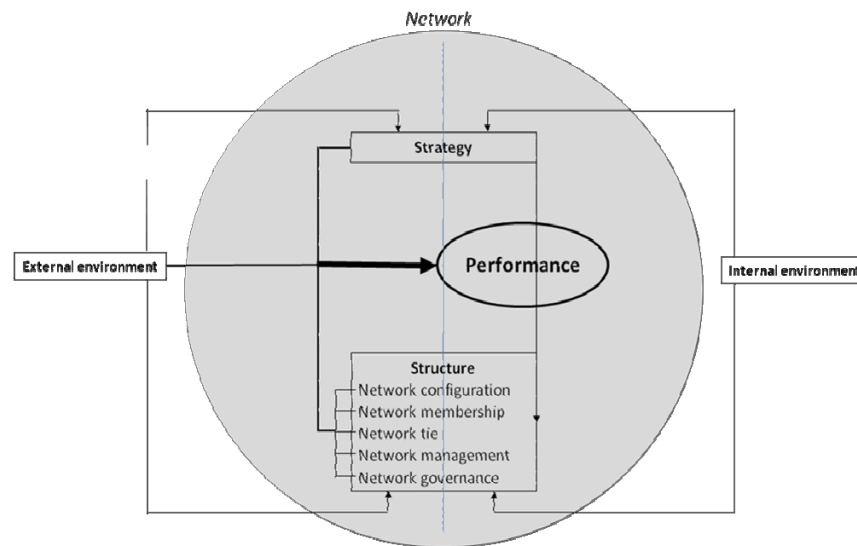


Figure 2: SSP paradigm adapted to the network context

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