NETGROW

Enhancing the innovativeness of food SMEs through the management of strategic network behaviour and network learning performance

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Preface

This report should be read and interpreted as the development strategy for the Netgrow performance measurement tool. The report has been prepared in collaboration between University of Gent (Belgium), Teagasc Food Resarch Centre (Ireland), University of Debrecen (Hungary), Institute for Food Studies & Agroindustrial Development IFAU (Denmark), Food Valley Organisation (Netherlands), and University of Bonn (Germany).

From a combined basis of scientific and empirical literature (with specific support by Magnus Nilsson, Loic Sauvee, Virginie Lefebvre, Frances Fortuin, Douglas Sorenson and Bianka Kühne) supplemented with consultations of experts from industry and academic environments, this report brings findings from historical and present sources together into a forward looking concept for a real-life performance measurement tool targeting networks at network level.

It is the vision that this strategic approach can produce a tool that will help funding sources, network management, policy makers, and other key stakeholders to increase the performance of networks as well as support the establishment and development of networks.

The development process has taken more than one year and many experts from EU countries and non-EU countries have contributed with valuable information and their expertise. It is our hope that a strong scientific basis and the real-life experience will lead to a successful and applicable performance measurement tool.

The Netgrow project team expresses the deepest gratitude to all experts who have contributed to this development process.

On behalf of the Netgrow team

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Contents

1 Executive summary

This report elaborates the development strategy of the Netgrow performance measurement tool. It is decided that the tool will be designed to measure learning and innovation performance at the network level. The report builds on earlier work in the project. This has included investigations of networks at case study level, research into scientific literature about performance criteria, key success factors of networks, indicators for performance measurement, dimensions of innovation and learning, and networks.

The tool development process encompasses all phases from idea to market-ready tool. This report covers the phases from idea and initial research onto the prototype tool. In order to achieve a sound basis for developing the tool, an approach combining state-of-the-art scientific literature and business literature with expert information has been chosen. Experts from academic environments and practitioners have contributed with valuable information throughout the development process.

Performance measurement at network level can be focused on economic performance, innovation performance, or other criteria. Before performance can be assessed, a sufficient group of indicators have to be identified and defined. Literature points at many indicators that are suitable for learning and innovation measuring performance at network level, but the challenge with these indicators are that many are generally of a non-objectively measurable nature. This is coherent with the difficulties of measuring learning, as learning is a process taking place in individuals and in organisations. As the performance measurement should be done at network level, it will also be required to link learning to activities in the network, and this may prove very difficult. In order to make such indicators work in a performance measurement tool, it will be necessary to develop appropriate definitions, scales as well as test the availability of data. This will be done in subsequent work packages of the project.

Literature point out a set of challenges and difficulties that need to be solved before a network performance measurement tool can be finalised. Such challenges are among others: how to measure learning; how to include a time dimension into the measurement; how to include different dimensions of innovation; and how to make the tool meet the specificities of the agri food sector? Another issue to take into consideration is the difference between clusters and networks. This is due

to the fact that there are already many tools and approaches used today to measure the performance of clusters.

Generally, such tools target the cluster organisation and build on information retrieved from cluster members and about the cluster's context. The identified tools include measuring innovation at member level, but none of the tools include learning as a criterion for measuring on itself or as an antecedent of innovation. Furthermore, no tools have been identified that specifically target the agri food sector. Therefore, it has been decided to develop the Netgrow performance tool as a food sector specific tool that will measure learning at member and network level, and consider learning as the antecedent of innovation. The practical approach to the tool is at this stage anticipated to be the input-output-outcome model, as this model allows for inclusions about the network's impact on the environment.

More work still needs to be done before the prototype tool can be introduced to the market. The work includes development of questionnaires for collecting data at member and network level, an analytical approach to processing and aggregating data from member level into network level; and an overall fine tuning and testing of the tool. Then it can be introduced to key stakeholders such as network management, policy makers, funding agencies, and other stakeholders.

2 Introduction

2.1 Purpose of this report

The purpose of this report (D.5.3) is to outline a model for the prototype tool for measuring performance of food sector networks at the network level; defined as Task 5.3 in the Netgrow project. The report is prepared as a development strategy for the Netgrow performance measurement tool covering the phases from idea to prototype tool; thus the report lifts historical and present scientific and empirical findings into a forward-looking context: The Netgrow Performance Measurement Tool. Very often performance is considered to be related to economic or otherwise tangible assets, but when it comes to networks then performance may also be more related to intangible assets such as learning and social relations.

The report will address four main aspects:

- Which dimensions of performances are relevant to measure when assessing performance at network level?
- Which specific requirements are relevant to include in a tool for performance measurement of food sector networks?
- Which tools are available for assessing performance of networks and what is the applicability to our purpose?
- What will be the outline of the Netgrow prototype tool for measuring network performance?

It is therefore relevant to identify criteria that can be used to express and assess tangible as well as intangible aspects of network performance, and that these expressions – or measurements – are defined at several levels: individuals, member organisations and network management. Furthermore, the network's outcome is perceived to have an impact on its environment by e.g. creating more jobs, bringing issues forward to policy makers, or otherwise contribute to growth and development within a certain geographic area. These external factors also need to be taken into account when evaluating the network's performance.

This project is defined to focus on the agri food sector. The networks studied within the project are in one way or another established with purposes of supporting innovation and company growth or

in any other way to provide forums for interdisciplinary collaboration and business development. For many networks a key success factor is *Innovation*; that means the network assesses its performance according to "how much innovation" the network has contributed to create within its members. Following this, it is highly essential to have a sound measurement for innovation both at member level and at network level.

Networks provide frameworks, activities and inspiration that can foster innovation within its member organisations. The network's level of innovation results from the innovation performance of its members. This is because innovation is the result of a learning process starting from an individual's gaining of new knowledge, implementation and exploitation of this knowledge. It is this process of transferring and exploiting knowledge we regard as Learning, and the overall result of learning should be an improved performance of the member organisation – maybe even innovations.

The overall vision for the Netgrow prototype performance measurement tool is that it can be applied at network level by different stakeholders in order to strengthen the innovation and learning within the network by pointing to a set of actions and improvements to be imposed at network level.

2.2 Defining the main concepts

2.2.1 Definitions

A range of main concepts relevant for networks, performance, innovation and learning are used continuously throughout the Netgrow project. These concepts are mentioned in Figure 1 and defined and discussed in later sections.

Figure 1: Defining the main concepts

Concept	Short definition
Network	A group of actors (also called nodes or players) connected by a set of repeated interactions of formal and/or informal ties
Network level	Considering the network as an organisation
Member level	Focus on firm or member organisations within the network
Network performance	The overall performance of the network, for example in terms of that part of the economic performance of network actors that can be traced back to networking activities
Performance criteria	Theme (or criterion) for which one or more indicators together can be used to measure the performance. Criterion may be defined such as economic, innovation, market or otherwise performance themes.
Indicator	Measurement point
Innovation	Implementing new combinations of existing resources, the examples of which are new or improved products; methods of production; sources of supply; ways to organize business; and the exploitation of new markets or new ways to reach existing markets.
Innovation performance	The ability to produce innovations within the different dimensions of innovation: innovation phases (lab to market); types of innovation (product-process-market-organisation); innovation concept (radical/incremental); and the innovation process (effort, activities, and results). Measured at company level and data are aggregated to network level.
Learning	The ability of an organisation to take up new knowledge, process it and exploit it leading to changed behaviours

Network learning	The ability of an organisation to combine knowledge resources by means of formal and informal interaction with other network partners
Network learning performance	The performance at network level only relating to learning (as antecedent for innovation)

(based on D.1.1, D.5.1 and minutes from SIM-meetings 2011-2012)

2.2.2 Summarising the most important findings from earlier work

Performance measurement is a complicated matter as it requires a set of indicators and a range of performance criteria to be measured upon (Kenis and Provan, 2009). From literature it is evident that performance measurement can focus on tangible (measurable) and intangible (non-measurable) criteria such as learning. In order to understand networks, the key success factors for networks, and to identify most network-relevant performance indicators, several papers have been prepared. The most important findings are summarised below.

D.2.1, D.2.2 and D.2.3: Reports about case studies analysis of food sector networks in EU and selected non-EU countries. Nearly 40 case studies of networks have been carried out across nine EU countries and selected non-EU countries. The overall purpose of the case studies was to understand how different networks (varying according to size, type of members, goal, strategies and outcomes) could impact member's innovation from a real-life point of view. The case studies were based on interviews with stakeholders from the triple helix, i.e. network managers and participants, research institutions and policy makers. Central topics in the interviews include the network successes, how the network had contributed to innovation, how open/closed was the network, how close were the linkages between members, issues about network management and governance, and finally a few questions about how to measure the performance of a network. The main conclusions from the case studies relevant for this D.5.3 encompassed a **broad approach to defining and measuring innovation as well as performance**. Other outcomes were that **performance was related to the network strategy and level of measurement** (member or management), and examples of **indicators and proxies** were given.

D.5.1: Key issues of success factors in networks. Initially, this deliverable outlines a definition of networks and discusses different typologies of networks. Based on a comprehensive literature

review, findings about network inception and configuration, network membership, and network management and governance are outlined and it is discussed how these criteria may impact network performance. The scientific findings are supplemented by results of the case studies (cfr. D2.1-2.3). Examples of how the performance criteria are applied in different network typologies are presented. In relation to the present Deliverable (D.5.3), the deliverable about key issues of success factors **contributes with a general understanding of levels in networks, network typologies, and network performance at more levels.**

D.5.2: List of indicators for measuring network performance. This deliverable identifies measurable and non-measurable indicators that can be applied in performance measurement at several levels in networks. The deliverable is produced based on a comprehensive literature review (D5.1) and results from case studies (cfr. D2.1-2.3), and presents the results of discussions sessions with network managers and businesses on how to measure network performance. A key issue in the deliverable is the identification of four requirements to selecting indicators for performance measurement, see Figure 2:

Figure 2: The four requirements to indicators for performance measurement

Requirement	Explanation
Universality	The indicator measures the same concept / item under different circumstances. This allows comparison under various working conditions
Measurability	The data required can be measured /expressed in metrics or non-metrics
Consistency	The indicator measures consistent with organisational goals
Inclusiveness	A control ensuring that the selected indicators cover all pertinent aspects relevant for the performance measurement

The deliverable also revealed that some indicators may need adjustments to express a measure relevant for the performance measurement in question. An example is the indicator "innovation uptake", which may be interpreted differently depending on the context. For the present D.5.3, the most relevant findings from this deliverable are a list of indicators with measurable and non-measurable indicators for measuring learning and innovation performance on several levels in the network (e.g. member, network and network management level). It became also **clear from D5.2**, that there is **no universal selection of indicators** for measuring network performance; and that

network performance measurement must take network strategy, - goals, and - activities, as well as the time of measurement into consideration.

2.2.3 Structure of the report

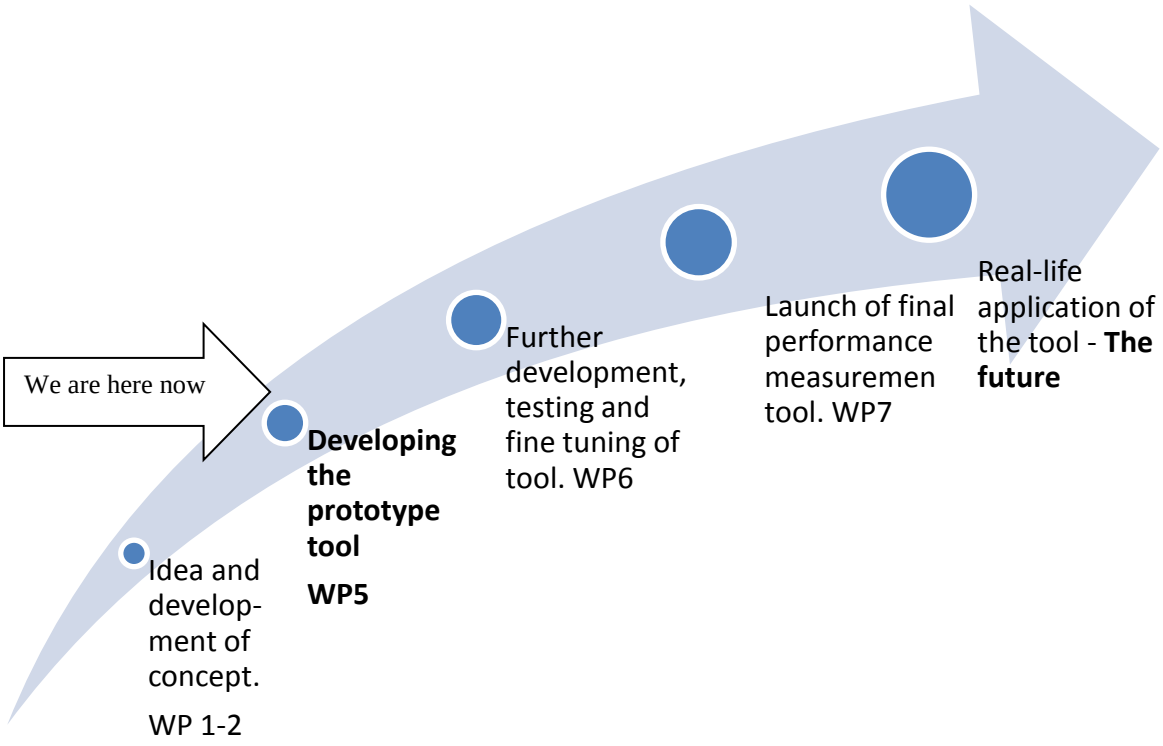
Chapter 3 gives an overview of the methodological approach to this Deliverable. Hereafter, in chapter 4, the challenges of performance measuring are presented including critical points and questions about the selection of indicators and inclusion of a time dimension. As such, chapter 4 is very central for the development of the prototype tool. Chapter 5 investigates which performance measurement tools are available today and discusses the applicability of such tools for our prototype tool supported by the results of the international expert workshop. Research and findings are tied together in chapter 6 where an outline of the prototype tool is presented. In Appendices 8.1-8.3 suggestions for measurements of learning performance and innovation performance are provided.

3 Methodological approach of Task 5.3

3.1 Work required to finalise the performance measurement tool

This Deliverable outlines a development strategy for the prototype tool based on a combined scientific and empirical approach. The prototype tool is as such not yet ready for launch. At this stage of the project, "prototype" is defined as a representative of the performance measurement tool, but in a scaled-down version. The latter refers to the fact that the development and fine tuning of prototype tool into a market-ready tool is strongly coherent with the development work taking place in subsequent work packages WP6 and WP7, as indicated in Figure 3.

Figure 3: The steps of the tool development process



In subsequent work packages of the project, a template with expressions for performance measurements will be pilot tested. This should identify those expressions of indicators and adjacent proxies that should be used in the questionnaires designed for collecting data to use in the performance measurement tool. Therefore, the questionnaires and the tool refinement process are

interlinked; thus the prototype tool will be refined and finalised, as testing and development of the questionnaires proceed. Finally, the performance measurement tool with the adjacent questionnaires will be launched, and training on its use by key stakeholders can be initiated. Information about the performance measurement tool will be provided directly to key stakeholders as well as on the project's website www.netgrow.eu.

3.2 Design of the literature review

In Deliverables prior to this one, literature reviews have been conducted to meet the purposes and research themes of the respective deliverables. Figure 4 outlines key research issues from the previous deliverables and identifies the core research themes investigated to meet the purpose of this Deliverable. Particular focus was given on subjects important for developing the prototype tool. This refers to subjects such as defining network learning and innovation performance at network level; coherence between learning, innovation and network performance; applicability of existing performance measurement tools; and the concept of additionalities which is relevant for learning as well as assessing network outcome.

Figure 4: Key research themes in previous work and this Deliverable*

Research theme	**D.2.1, D.2.2., D.2.3**	**D.5.1**	**D.5.2**	**D.5.3**
Defining networks and network levels	Empirical investigation of network structures, achievements and levels	Defining networks and different network typologies, Defining network levels	Identifying indicators for network levels	Differentiation between networks and clusters
Defining performance / network performance	Empirical investigation of network performance and performance indicators	Researching key success factors for a set of performance criteria at network and member levels	Researching requirements to performance indicators (economic, learning and innovation) at different levels and their measurability	Investigating the expressions and measurements of performance indicators for learning and innovation at network level
Defining learning /	Empirical investigation of	Identification of common indicators	Researching the complexity of	Researching and defining the

Research theme	D.2.1, D.2.2., D.2.3	D.5.1	D.5.2	D.5.3
network learning	dynamics of network learning	at firm/organizational level	network learning. Research about dimensions of learning and indicators	concept of network learning incl. different types of learning
Defining innovation / network innovation	Empirical investigation of innovation procedures and achievement in food networks	Identification of common indicators at firm/organizational level	Research on indicators for innovation in networks at different levels – scientific and empirical. Research about dimensions of innovation and indicators.	Researching the coherence between innovation and network performance; mainly at network level; and about dimensions of innovation and performance measurement
Coherence learning, innovation and network performance	Empirical investigation of learning, innovation and impact on network performance	Research on success factors and barriers for network performance, with specific focus on learning and innovation	Identification of indicators for performance criteria and indicators, including those for learning and innovation at different levels of the network	Research on different types of learning and innovation in networks, and the impact on network performance at network level
Specificities of the agri-food sector relevant for innovation and learning	Investigating how the case study networks contributed to growth and innovation in member companies	-	Empirical investigation of indicators with specific relevance for the food sector	Investigation of business literature about performance measurement of (food) clusters, applicability of tools
Specificities of innovation and learning related to company size	Empirical investigation of the impact from company size on network outcome (member level)	Research on indicators with regards to company size	-	-
Additionalities	Empirical investigation of successful outcomes of	-	-	Research into the concept of additionalities, the impact on

Research theme	D.2.1, D.2.2., D.2.3	D.5.1	D.5.2	D.5.3
	network participation			learning, and the relevance for network outcome at network level
Network governance and management	Empirical investigation of network management and governance structures, and impact on network performance in general	Research on network governance and management as key success factors for networks at network level	Investigating indicators from literature and empirical sources for network governance and management	Research on management's impact on network performance at network level

*blank fields indicates that this area hasn't be investigated in the according deliverable

As can be seen from Figure 4, the flow in the literature review builds up across the range of deliverables in a matrix-like system. Initially, literature has been consulted on a more general level about networks, innovation and key success factors. Then, research has emphasised more detailed issues relevant for performance measurement and indicators. This process has led to the decision of focusing the performance measurement tool on measuring learning and innovation performance at network level. Therefore, a specific literature review has been conducted to investigate deeper into this matter emphasising the coherence between learning, innovation and network performance, and a better understanding of different types of learning, the dimensions of innovation, and performance measurement tools. All relevant sources (scientific and empirical) are listed in the Bibliography (section 7). In this report the outlined development strategy for the prototype tool is supported by scientific and business literature to ensure that the development process and outcome is based on significant scientific and business literature.

3.3 Design of discussion session in Bologna

To support the literature review and research from empirical sources, an international workshop has been hosted in Italy in April 2012. The purpose of the workshop was to gain more information about performance measurement tools applied in real-life; to understand the importance of different

kinds of learning for network performance; and to learn more about the coherence between innovation, learning and network performance. Participants in the workshop included practioners with experience in network management and performance issues; academics with experience in performance measurement; and Netgrow team members. The participants at the workshop aimed at answering the following four questions:

1) What kind of tools for measuring the performance of networks fostering innovation and collaboration between members are currently used? What are the strengths and weaknesses of such tools? Why?

2) What kinds of learning occur in inter-organizational networks aiming at innovation? Do you think all these kinds of learning are worth measuring when trying to assess the performance of such networks? Why?

3) Which elements are essential for measuring learning and innovation performance?

4) How can performance measurement tools be adapted to assess different dimensions of innovation? Should aspects of learning be included in the innovation performance tool?

As thirty people participated in the workshop, three groups were formed. Each group included Netgrow members, academic and real-life experts. A Netgrow member was appointed rapporteur within each group. The results of the workshop are presented in section 5.3.

4 Challenges of a network performance measurement tool

4.1 The complexity of defining network performance and relevant indicators

Performance is known to be a complex concept, especially concerning its measurement. Authors in different disciplines have generated different views on which criteria, defined as standards, to base a judgement (Kenis and Provan 2009). Also the question on which performance indicators, used to measure what a criterion is in its operational terms, should be included in the performance measurement system have troubled many scholars. As a consequence, a large number of performance criteria and indicators are used in literature as well as suggested by real-life experts and network representatives. Although scholars have proposed different ways to evaluate network performance, a common characteristic of all performance measurement systems proposed is the focus on the firm or organizational level. Network performance seems often to have been reduced to the performance of the enterprises participating in the network (Provan, Fish et al. 2007; Lefebvre, Molnár et al. 2010).

In its nature, performance measurement requires a set of indicators which together can provide the basis for a sound, complete and relevant measuring of the performance of the network. The most challenging issue of developing this prototype tool has proven to be the identification and definition of indicators. Another important challenge has been to select the most appropriate performance measurement tool that could suit our purpose.

The Netgrow prototype tool is intended to be used for measuring the learning and innovation performance at the network level and this assessment will be based on data retrieved from member level.. It is also foreseen that the tool will include both quantitative and qualitative indicators and measurements that together will fulfil the concept of inclusiveness (Figure 2).

4.2 The question of how to include innovation and learning dimensions into performance measurement

When discussing innovation performance it is essential to investigate the coherence between innovation performance measurement and the phases of the innovation process. Further the question of incremental vs. radical innovation, or dimensions of innovation must be considered, too. The dimensions of innovation refer to (Pittaway et al, 2004):

- Product innovation
- Process innovation
- Organisational innovation
- Market innovation

The NetGrow project adopts a mainstream view on the concept of innovation. As a starting point we go back to Schumpeter's definition of innovations as being new combinations of existing resources (Schumpeter, 1943). Following Schumpeter rather closely we adopt the following definition:

An innovation is defined as implemented new combinations of existing resources, the examples of which are new or improved products; methods of production; sources of supply; ways to organize business; and the exploitation of new markets or new ways to reach existing markets.

A key issue of this definition is related to the term 'implemented' (a term used by e.g. Chesbrough, 2003; Smith, 2005). Behind the emphasis on implementation is the distinction between innovation and invention. Innovation differs from invention in the sense that invention is the first occurrence of an idea for a new product or process etc., while innovation is the first attempt to carry it out in practice; to implement it (Chesbrough, 2003; Fagerberg, 2005). In many cases, and in a traditional understanding of the distinction between innovation and invention, this means to bring the invention to the market. The use of the term 'implemented' however include not only commercial application since not all inventions require a traditional market on which they can be launched. For example new products or ways to organize work can be implemented in a non-market setting such as the public healthcare system (as with lean production principles applied to healthcare) without being brought to commercial markets.

Another central issue when it comes to defining innovation is the question of what is ‘new’and to whom. Smith (2005) discuss this in the specific context of product innovation by distinguishing between ‘new’ and ‘significantly improved’ products. His point is that a 'new' product is a product whose characteristics or intended uses differ significantly from those of previously produced products. Such innovation can involve radically new technologies, can be based on combining existing technologies in new uses, or can be derived from the use of new knowledge (Smith 2005). By comparison, an 'improved' product is an existing product whose performance has been significantly enhanced or upgraded. A simple product may be improved (in terms of better performance or lower cost) through use of higher-performance components or materials. A complex product which consists of a number of integrated technical subsystems may be improved by partial changes to one of the subsystems (Smith 2005).
He argues that it is at the level of the firm or organization that the level of newness is assessed; i.e. that the product should be new (or significantly improved) to the enterprise while not necessarily new to the market, although it should not be pure imitation (Smith 2005). This connects to a wider debate on (product) innovation where the most commonly used distinction is that between innovations that are new to the market (line extensions), new to the firm (me-to products), and new-to-the-world products (see e.g. Lukas & Ferrell, 2000).

Another way to approach the question of ‘newness’ of innovations is to distinguish between incremental and radical/discontinuous (the terms autonomous and systemic are also used) (Edquist, Hommen, & McKelvey, 2001; Tushman & Nadler, 1996; Utterback, 1996). An incremental or autonomous innovation is one that can be introduced to the market without massive modification of related products, processes, organization and markets while radical/discontinuous/systemic innovation require a more or less complete redesign of related products, processes, organization and markets (Lam, 2005).

Results from previous work in Netgrow (findings from discussion sessions and workshop) point to the fact that measuring the innovation performance at company level very often is related to indicators such as: number of patents, number of projects, number of new products etc. For the Netgrow performance measurement tool the consequences of this are that “innovation” generally should be assessed according to measurable indicators (refer to D.5.2), and that innovation should be considered as part of the impact assessment (or outcome) part of the tool. By using this

approach, the coherence between innovation phase, innovation dimension, network strategy and applied resources would be possible (Omta & Folstar, 2005; Hansen & Birkinshaw, 2007; Chen & Guan, 2011).

The overall recommendations for including different dimensions of innovation into the performance measurement tool should encompass considerations about network strategy, resources applied, measureable output, and the long-term outcome of innovation work. In this light, the matter of whether performance is assessed for e.g. product or process innovations will have less impact on the network's overall performance. In Annex 3 (section 8) an overview of validated indicators and scales is compiled for innovation and collaboration for innovation.

Including collaboration structures into the performance measurement tool is highly relevant as this factor would include a measure for the members' abilities to collaborate, to take up knowledge, and the network's ability to function as a facilitator for knowledge transfer. (Howells, 2006; Klerkx & Leeuwis, 2009).

Accordingly the concept of innovation typically infers learning, as learning may be regarded as the antecedent of innovation. Any process of innovation entails learning, either between individuals within an organization (intra-organizational learning) or across or organizations (inter-organizational learning). Our focus in this project is on the latter: inter-organizational learning taking place in a network setting (as compared to for example in a joint-venture or strategic alliance setting). In this respect, our scientific foundations draw on the literature on inter-organizational knowledge transfer and learning, learning or knowledge focused network literature, and open innovation. We also draw on theories on clusters, industrial districts, systems of innovation. In the NetGrow project we conceptualize network learning as follows:

Network learning is the ability of an organization to combine knowledge resources (both tacit and explicit) by means of formal and informal interaction with other network partners (in a dynamic process).

At the heart of this research lies the realization that the competitive advantage of a firm is generated not only by effective and innovative utilization of its internal resource stocks but also by

exploitation of external resources (Cohen & Levinthal, 1990; Teece, Pisano, & Shuen, 1997). From a network perspective this is illustrated by the fact that knowledge transfer across organizations increases both the performance and the innovativeness of the networked firms (van Wijk, Jansen, & Lyles, 2008). Many of the seminal contributions to this literature – regarding for example the tacit-explicit interplay in learning processes (Nonaka & Takeuchi, 1995); the centrality of absorptive capacity (Cohen & Levinthal, 1990); knowing in practice versus knowledge as possession epistemologies (Cook & Brown, 1999; Orlikowski, 2002); and the role of communities of practice (Brown & Duguid, 1991) – include implicit or explicit assumptions about spatiality. Therefore we have to distinguish between clusters and networks in a wider sense (see section 4.3.1 for further elaboration).

Central to this is the issue of how knowledge is transferred across organizational boundaries within a network and how knowledge is absorbed by firms. The concept of absorptive capacity is central to any discussion of learning. Absorptive capacity, as originally defined by Cohen and Levinthal (1990), is based on the assumption that firm-external knowledge is often critical to the innovation process and that the level of prior related knowledge is central to the ability to identify and use outside knowledge. Absorptive capacity is thus the "ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990 p.128). **Inter-organizational learning thus pivots on the organization's absorptive capacity.**

Inter-organizational knowledge transfer or learning is of course also related to the nature of knowledge. While this is not a topic on which we will elaborate to any greater extent, it should be noted that many different typologies have been suggested; often with ancient antecedents. One such classification of knowledge dimensions is that of Johnson et al. (2002) who discuss knowledge in terms of know-what, know-why, know-who, and know-how. The first two of these are relatively easy to codify. *Know-what* is described as knowledge about facts (information) while *know-why* is knowledge about principles (why things work in a certain way). The two latter knowledge components are generally more difficult to codify. *Know-how* refers to the skill or ability to perform a task while *know-who* refers both to information about who knows what and to the social ability to cooperate and communicate (more elaborate treatment can be found in antecedent work such as that of Polanyi, 1958; Ryle, 2000:1949).

Lastly, the literature on learning related to degree of tacitness (touched upon above) is a central element in any discussion of inter-organizational learning. Drawing on Polanyi's seminal works on the topic (most elaborately treated in Polanyi, 1958) Nonaka and colleagues (e.g. Nonaka, 1994; Nonaka & Takeuchi, 1995) offers a model of knowledge creation and learning that argue for viewing the learning process as interplay between the tacit and explicit dimensions of knowledge and knowledge transfer. It pivots on processes of socialization, articulation, combination, and internalization. This view on learning explicates four basic patterns for creating knowledge:

Tacit to tacit (socialization): socialization through observation, imitation and practice. Learning difficult-to-articulate-and-transfer skills by doing and observing.

Explicit to explicit (combination): combine discrete pieces of explicit knowledge into a new whole. E.g. a firm's financial report is new knowledge created through combination of existing explicit knowledge. In innovation, existing knowledge about markets/customers (and consumer behavior) may be compiled and when combined with existing knowledge on product characteristics, new knowledge can be created in the form of a market innovation (new ways to reach markets or approach consumers) or organizational innovation (new ways to organize marketing and sales channels to exploit opportunities identified in existing market-product knowledge).

Tacit to explicit (articulation): making tacit knowledge explicit. Nonaka exemplifies with a software developer that trained with one of Japans premier bakers to explicate the secret of his outstanding but difficult-to-codify baking technique. After a year of trial- and-error the software developer produced a new kitchen appliance machine that was able to reproduce the baker's special kneading technique. The appliance set a record sale upon its launch. Thus the explicit crafts-like knowledge of a famous baker was learnt by a product developer that then explicated it in a set of product specifications for a baking machine.

Explicit to tacit (internalization): When new explicit knowledge (e.g. the product specifications for the baking machine) is disseminated/shared in an organization it is used by the employees to broaden, extend and reframe own tacit knowledge (i.e. internalized).

For different types of innovations there are different demands both on the learning process (e.g. socialization, articulation, combination, internalization) and on the level of learning (incremental innovation - smaller learning requirement [e.g. learning by doing] or discontinuous innovation - substantial learning requirements [e.g. completely new technologies or ways of doing business]).

The above discussion about different types of learning and the approach to learning is thus highly relevant for developing a tool for measuring learning performance. The discussion points to the fact that learning should be measured at the member-level, and then measurements must be aggregated into network level. Furthermore, it is quite clear that the performance measurement tool must be developed in such a way that "learning" may be related to the factors leading to learning (such as network activities or contacts within the network), and to the implementation of learning into the member's organisation. The latter particularly refers to procedures for storing, transferring and exploiting knowledge. Concerning network-derived factors that lead to learning, the performance measurement tool must include the competences of network management within facilitating knowledge transfer. This evaluation would connect with the network activities and the outcome of the activities, and with the general management skills including competences within mediating and bridge-building.

As the tool will focus on measuring learning and innovation the indicators required must be capable of supporting this approach. Reviews of literature and earlier Netgrow work have shown that there are many different indicators that can be used for this purpose (Beamon, 1999; Aramyan et al, 2007; Fabbe-Costes & Jahre, 2008). Many of these indicators are measurable; mostly in metrics. Examples of such indicators (derived from D.5.2) are: number of new products, number of patents, number of projects or increase in R&D spending.

Further research and the workshop has underlined that non-measurable indicators are very relevant to include when measuring the learning performance at network level. This is due to the fact that learning performance at network level is an aggregation of information about members' learning within the network; and that learning cannot be exclusively expressed in metrics. A comprehensive list of non-measurable indicators for learning and innovation is given in appendix 1 and 2.

4.3 Other issues for developing the Netgrow performance measurement tool

The paragraphs above and earlier work in Netgrow point to a range of other issues that must be considered when developing the Netgrow performance measurement tool. These issues have been defined in literature as well as underlined by the participants at the workshop. The issues are pointed out based on their importance for developing a tool that targets learning and innovation in food sector networks. The issues are:

- A need for differentiating between clusters and networks
- The question of how to include a time dimension in a performance measurement tool

4.3.1 Differentiation between clusters and networks

In relation to the issues of innovation, inter-organizational networks for learning and knowledge transfer, and firm and network-level competitiveness, the literature on regional networks is often applicable. Therefore, and for empirical reasons detailed below, a comment on the relationship between the theories on networks vis-à-vis clusters is warranted.

The view that proximity and the local milieu plays an important role in explaining competitiveness and innovation is widely recognized in the literature (e.g. Bjørn T. Asheim, Cooke, & Martin, 2006; Enright, 2000; Gertler, 2003; Malmberg, Sölvell, & Zander, 1996; Michael E Porter, 2000; Michael E Porter & Stern, 2001). A strong argument for this position is the well-documented tendency for regions and cities to show a remarkably high level of specialization in one or a few specific industries, and the tendency of most industries to be concentrated to a limited number of regions (Ellison & Glaeser, 1997, 1999; Krugman, 1991b; Malmberg & Maskell, 1997). Economic activity is concentrated in space; or as Krugman put it: “What is the most striking feature of the geography of economic activity? The short answer is surely concentration… production is remarkably concentrated in space.” (Krugman, 1991a p.5). These spatial concentrations are referred to as ‘agglomerations’.

Subsequently, the diverse body of literature devoted to explaining these phenomena – using concepts like ‘clusters’, ‘industrial districts’, ‘learning regions’, and ‘regional innovation systems’ etc. – is referred to as ‘agglomeration theory’. In this literature, there is a strong tradition to emphasize the importance of localized learning, knowledge spill over, and localized capabilities

(e.g. Björn T Asheim & Coenen, 2005; Gertler & Wolfe, 2006; Maskell, 2001; Maskell & Malmberg, 1999). It is argued that spatially clustered networks of similar and related actors carry positive effects for the actors as it enhances creativity, learning, and knowledge spill over and thereby also the innovative capacity of the firms in the region (Malmberg, et al., 1996).

Most commonly this literature is represented by the theory of clusters (though other concepts are sometimes also used). Porter's original contribution focused on the competitive advantage of nations rather than regions, by arguing that the basic unit for understanding national competitiveness is the industry, or rather clusters of industries connected by vertical as well as horizontal relationships (Michael E. Porter, 1990). The focus has, however, more and more come to be on the regional level as clusters are seen as spatially bounded. A cluster is defined by Porter as follows: **"Clusters are geographical concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g. universities, standard agencies, trade associations) in a particular field that compete but also cooperate."** (Michael E. Porter, 2000 p. 15).

Based on Porter's definition, four characteristics of clusters can be identified: [a] the existence of a geographical agglomeration; [b] within the same sector or field; [c] the inter-connectedness of these actors, both vertically and horizontally; and [d] the cooperation and competition amongst the actors. A cluster can thus be seen as a specific form of network that is defined in terms of its geographical dispersion and sectoral composition.

The definition of a network does not entail a spatial or sectoral dimension. **Networks are defined as a set of actors connected by a set of formal and/or informal ties sustained over time**. The actors are firms (competitors, suppliers, customers, auxiliary businesses etc.), individuals (boundary spanners etc.) knowledge centers (universities and research centres etc.), and other actors (network organizations, governments, special-interest groups, industry organizations etc.). The ties are relationships between the actors. Ties may be formal (contractual, institutionalized etc.) or informal (social, trust-based etc.). (Based on Borgatti and Foster, 2003; Granovetter, 1973; Hamdouch, 2010; Owen-Smith and Powell, 2004).

Networks may be established with a bottom-up approach in which case the initiative and drive come from the members. The opposite approach of a top-down established network refers to the situation where a network is founded based on achieved funding or a policy decisions. The top-down networks generally tend to be more complex than the bottom-up networks due to the wider array of activities, stakeholders and management structures[1]. Generally, networks are established with a focus on specific issues, industries, or defined geographic areas. Networks have organisations or individuals as members (some networks have both groups), and the core issue for a network is to establish the contacts between individuals; that is **the network is a forum**.

The reason for making this distinction between networks and clusters (and other similar spatially defined concepts) is that in the empirical analysis, many of the formal networks use the term 'cluster' to describe themselves. While this does not constitute a methodological problem, it is important to explicate the difference between a cluster and a network and to stress that our interest is not limited to spatially clustered networks of similar and auxiliary businesses; though our findings may be applied to this context whenever relevant.

The important point here is that a network differs from a cluster particularly with regards to the purpose of the organisation: The network is a forum for individuals to meet and exchange information through an array of activities (hopefully leading to increased business and more learning), whereas the cluster is an area with higher than average density of business entities and knowledge institutions with particular interest in a specific industry often driven by competitive advantages. Naturally, there may be networks established within a cluster as well as networks with members from different clusters.

Both networks and clusters may have objectives of contributing to economic growth, business development, more innovation, and an overall positive impact on the society. As both types of organisations may receive public funding there is a demand from funding sources to know the outcomes of the resources spent and the (beneficial) impact the organisation actually has on society.

[1] More findings and explanations are given in D.2.1. and D.2.3 of Netgrow

4.3.2 The question of how to include a time dimension

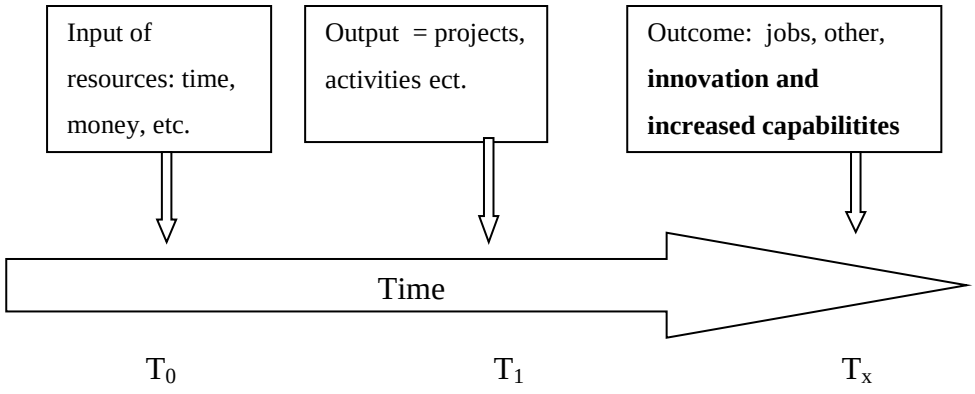
Performance measurement, in its nature, needs to include a time span, as performance is the changes in outcome over time. When measuring the performance at network level, there are more issues to consider about "time":

1) At what stage of the network life cycle does the measurement take place?
2) Is the measurement carried out with a short term or long term perspective?

The network's life cycle follows the path from inception, development, growth to maturation and then either decline and close, or change of strategy to gain revival. The time at which the performance measurement is done is thus related to the maturity of the network, and the maturity is connected with the involvement from the members, the amount of activities and contacts within the network, growth in membership base, financial sustainability and other factors. The key point here is that a young and immature network will perform differently from an established well-integrated network. It is also more difficult to assess the impact of a mature network on society, as it becomes more unclear to relate the outcomes to the network's activities.

The Netgrow prototype tool will focus on learning and innovation performance, thus the outcome of the network activities may be measurable at a different time from when resources were put into the network, Figure 5.

Figure 5: Including a time dimension into the performance measurement



As Figure 5 above shows, learning and innovation will probably only occur after some time. Therefore, when measuring the learning and innovation performance of networks, it is essential to consider whether it is a short-term measurement or long-term perspective to be included in the selection of indicators. This was a key issue pointed out at the workshop in Bologna. For a short term measurement indicators such as knowledge flow and participation in seminars could be used, whereas for long term measurements indicators such as transfer of IP or market-introduced new products would seem more relevant. In case of the short-term perspective, learning is often not be measurable, as the network members may have to implement new routines for information transfer internally in their organisation, and the organisation may also need to adapt to changes in the environment. Furthermore, measuring the innovation performance depends on the kind of innovation, the innovation phase, and whether an innovation has actually been produced and introduced to the market. Therefore, short term measurements of learning and innovation performance must take into account that learning and innovation take some time to develop and implement. The long term perspective offers better opportunities to assess learning and innovation performance at the network level, as well as other outcomes from the network.

5 Tools for measuring performance

5.1 Approaches of existing performance measurement tools

Together, the reviews of scientific and empirical literature; the case studies; and the discussion sessions and workshop have provided a strong and sound basis for moving forward with the tool development. A first approach is to select a model for the performance measurement tool for later refinement. The more detailed development process including statistical analysis and data collecting methodologies will be based on the Guidelines from the Olso Manual (OECD, 2005) and other relevant scientific literature and methodologies. Reviews of empirical literature about performance measurement of clusters and networks, and about learning identify several models that could be used for the Netgrow prototype performance measurement tool. These models are listed below and explained afterwards:

a) Benchmarking tool
b) Input-output-outcome tool
c) Impact assessment tool
d) Cluster evaluation tool

The benchmarking analysis is widely used for **comparing** different organisations such as companies or clusters. Benchmarking is performed to gain information about an organisation's performance and competitiveness in comparison to its peers or competitors and can be used for making strategic decisions. The analysis relies heavily on quantitative indicators and is based on comparison of specific indicators with peer references. The results of a benchmarking analysis can be used to document success and to identify opportunities for improvement (VDI, 2011).

The German cluster organisation Kompetenznetze has developed a benchmarking tool particularly applicable for clusters. The tool concentrates on the cluster organisation and the community of cluster actors. Economic or other effects of the cluster on the entire industrial sectors or the development of regional strengths cannot be assessed easily and therefore are not considered in the German model. The dimensions and indicators used are presented in Figure 6.

Figure 6: Dimensions and indicators of the German cluster benchmarking tool

Dimension	Indicators
Structure of the cluster	➢ Age and legal form of the cluster organisation ➢ Driving forces and degree of specialisation ➢ Composition of cluster membership ➢ Regional concentration of cluster members ➢ Utilisation of regional growth potential ➢ Internationalisation of cluster members ➢ Nature of cooperation between cluster members
Cluster management and governance	➢ Number of employees ➢ Human resource competences and development in the cluster organisation ➢ Clarity of roles in the cluster management and with members ➢ Strategic planning and implementation processes ➢ Thematic and geographical priorities of the cluster organisation
Financing	➢ Current sources of financing of the cluster organisation ➢ Financial sustainability of the cluster organisation
Achievements and recognition	➢ Visibility in the press, media etc. ➢ Number, origin and geographical dimension of external cooperation requests ➢ Impact of the work of the cluster organisation on R&D activities of the cluster members ➢ Characteristics of cooperation with other international clusters ➢ Impact of the work of the cluster organisation on international activities of the members

(VDI, 2011)

The results of the benchmarking analysis are presented according to values or scores. So within a reference frame (defined according to the peers), the scores of the cluster in question will provide an indication of performance (e.g. a single performance indicator) or a multi-dimensional indicator by using a radar chart. The latter could be relevant for showing a cluster's geographical outreach,

i.e. how strong is the regional, national and international outreach compared to other clusters? (VDI, 2011).

Overall, applying a benchmarking approach to performance measurement may be regarded as a self-assessment tool, as the analysis is based on information from the cluster management itself. As such the benchmarking analysis cannot be compared with an evaluation. Furthermore, benchmarking does not qualify for any rankings and does not give any information whether specific characteristics of clusters or their cluster organisation can be considered as very good or rather less valuable. However, the collected data for the German benchmarking approach can be used for an analysis of the cluster organisation management excellence. The benchmarking tool includes a list of Recommendations for the cluster organisation on how to improve in one or more of the dimensions outlined in Figure 6 above.

The impact assessment analysis aims at investigating the impact of a cluster or network; very often with the purpose of justifying public spending on clusters or networks. This is done by assessing the impact on more levels: members, industry (and if possible on society). The focus of this analysis is to assess the impact of a specific cluster or network as an organisation. The analysis can be focused on two different types of impacts of participating in networks or clusters: 1) Behavioural effects, and 2) Economic impacts. The method requires a set of quantitative longitudinal data covering a certain period of time, and statistical modelling. Control groups must be established to detect the impact from participating in the cluster or network. An example from the Danish report DASTI shows that for each company participating in the cluster or network, a control group of 10 "twinning" companies has to be established. In this coherence, a twin company is a company with similar characteristics to participants but with the difference that it did not participate in the cluster or network. This approach would create a counterfactual situation allowing analysis of what would have been the situation without the innovation network or cluster (DASTI, 2011). An advantage of the impact assessment model is that it can analyse behavioural impacts, which in the case of Netgrow would link very well to the issue of measuring learning performance. However, the impact assessment approach is not considered as the most relevant one for the Netgrow tool, as the comparison of between "members" and "control group" would require

extraordinary efforts in the performance measurement process making the tool too complicated to operationalise.

Another approach to performance measurement is the **input-output-outcome model** for clusters as presented by the German organisation VDI (Figure 7). The model has been developed in collaboration between VDI and the German initiative *Kompetenznetze Deutschland*. The latter is a government funded initiative to promote the formation of networks as forums for innovation. The basic idea was that networks would enhance the innovation capabilities of companies (including SMEs) by making use of widespread expertise and synergies. Further it was of central concern to link economy, science and research to accelerate the transfer of knowledge. Since 1999, the *Kompetenzenetze* (in English competence networks) has led to the formation of four regional food networks also known as the Competence Clusters (BMWi 2012). According to the VDI definition of a cluster, the cluster has three important dimensions: cluster participants, cluster management organisation, and the cluster's framework conditions (ESCA, 2012). Researching the Competence Clusters and the cluster definition of VDI point to the below mentioned issues which both clusters and networks have in common. Therefore, we argue that the input-output-outcome model is also applicable for networks.

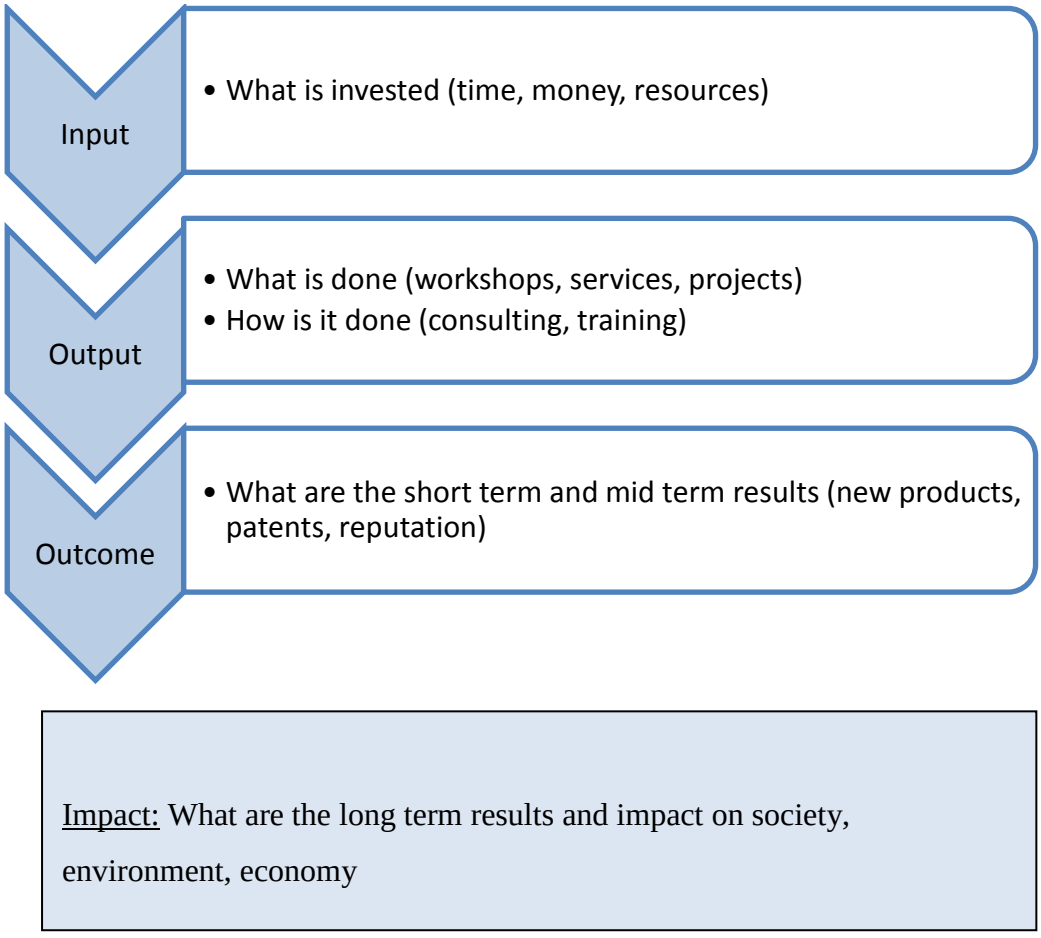
Common characteristics of clusters and networks:

- Both have a management organisation;
- Both have a group of actors participating. In clusters defined according to geographic density; in networks defined according to interpersonal linkages;
- Both may have a sectoral focus;
- Both have strategic goals that should be achieved by implementing a set of actions and activities;
- Both may have a goal of impacting on innovation, company growth and impact on society;
- Both demand management tools to help the organisation (cluster or network) perform better

The input part of the model refers to the investments into the cluster (time, money, personnel), output refers to the measurable outputs (number of patents, jobs, projects or innovations etc.) apparent at a defined time of measurement, and the outcome refers to the impact on society from the original investment.

The input-output-outcome model allows to establish a link between outcome / impact and input (invested resources), as the model measures the context of the cluster, the cluster organisation, and at cluster member level (Kind, 2009). Analysis of the cluster's context and the policy program is conducted through interviews with key stakeholders and workshops with policy makers. The analysis of the cluster organisation is based on a benchmarking analysis. The cluster's impact on member organisations is investigated through interviews with members, and finally, an international benchmarking of the cluster is performed.

Figure 7: Input-Output-Outcome model



The results of the input-output-outcome model consisting of the benchmarking analysis and the overall evaluation of the cluster is summarised into two sets of recommendations: one for policy makers and one for the cluster organisations.

As with all kinds of performance measurement, in its nature, changes in performance can only be assessed over a time period. The input-output-outcome model can be adjusted to measure input and output repeatedly (e.g. annually), whereas the outcome has to be assessed at a later time. The challenge is to relate outcome to the input.

Scientific literature has repeatedly underlined that measuring the learning performance is very complicated as the proxies may prove hard to identify and assess (Beamon, 1999; Aramyan et al, 2007; Fabbe-Costes & Jahre, 2008; Clarysse et al, 2009). The input-output-outcome model provides a tool for including assessments of learning performance into the evaluation of the outcome, as learning may be "translated" into behavioural changes that are only visible after some time. The application of the concept of additionality as proxy for learning is shortly introduced in the next section.

By using the concept of additionality we focus on what is done to promote learning in networks. This can be done by focusing on some generic functions that networks perform to promote learning and tracing (in some way) the results of these functions. In science/technology studies they differentiate for example between input additionality, output additionality, and behavioural additionality, but other classifications have also been suggested (see e.g. Falk 2007).

Basically the application of the concept of additionality will allow that the functions performed by the network management (e.g. by having match-making activities for members of a network) may lead to the firms initiating new innovation projects (referred to as input additionality since the firms invest additional input into innovation); being more successful or effective in their innovation projects (output additionality); and/or changing the way firms and other actors work with innovation (behavioural additionality for example if firms adopt a more open innovation approach). If relevant, there is also possibility to apply a distinction between first-order and second-order additionality. (Clarysse et al, 2009 p.1518). It should be noted that the activities executed/ coordinated by the network management are not on a detailed level (e.g. organising a conference) but on an aggregated level (sometimes the term 'function' is used rather than 'activity'). Basically, many activities (organizing meetings, sending out newsletters, co-organizing training sessions or courses, doing marketing and promotion activities for the network or cluster, funding projects etc.)

may contribute to one more generic function that the network performs such as promote interaction between members (and one activity may contribute to several functions).

The report from Oxford Research discusses a **model for evaluating clusters** to meet policy makers' demands for information about regional development, outcome of spending public money, development of clusters, and comparability between clusters of different structures, participants and sizes (Oxford Research, 2011). The cluster evaluation model is outlined in Figure 8. As discussed earlier there is a clear difference between clusters and networks. In case the Netgrow performance measurement tool will be developed from a cluster evaluation approach, then further refinement will be needed to address the specificities of networks.

Figure 8: Elements in the cluster evaluation model

Description of the cluster: Presentation of cluster initiatives, activities and management of activities.

Process analysis: Analysis of the activities carried out by the cluster using a web-based log. Activities (seminars, projects, meetings, press releases, reports) are reported by the cluster representatives.

Partner survey: Web-based survey of the cluster members with the aim of identifying the members' views on the cluster's activities and experienced effects. Survey focuses on cluster identity, participation in activities, collaboration as well as the cluster management's tasks and effectiveness.

Register analysis: A supplement to the above analysis. Development data for cluster member companies are monitored (data: turnover, number of employees, profit/loss and similar data). Purpose is to highlight joint development of cluster members over time.

International outlook: Benchmarking of this cluster with foreign most foremost clusters. Variables: number of members, funding structure, number of employees and services offered.

(Oxford Research, 2011)

5.2 Applicability of existing performance measurement tools to networks in the food sector

Caution should be taken when comparing clusters in e.g. international benchmarking analysis, as there are vast differences between the clusters across Europe. These differences refer to variables such as cluster size, age, purpose, specialisation, funding and internationalisation among other parameters, and this may have a strong influence on how the benchmarking results should be interpreted. Therefore it is necessary to analyse the cluster within its context including political and economic issues as well as local competitive advantages.

The discussion of different tools for evaluating performance of clusters and networks point to the fact that most tools target cluster organisations, and only few are applicable for networks. Furthermore, the tools target assessment of the cluster's overall performance where innovation is only one of the dimensions in the tools. Learning is not a key issue in the tools or models presented here; learning is more an implicit feature of innovation and not assessed on its own.

None of the tools seem to be developed specifically to focus on food sector networks or food clusters, and as such the measurement tools do not take the food sector's specificities into consideration. Such specificities encompass the industry's structure with many SMEs, the value chain structure, internationalisation patterns, and the supporting industries and their importance for the food sector's overall competitiveness.

The Netgrow tool will focus on measuring learning and innovation performance in networks, and as such the tool must include measurement at member level and network organisational level. Considerations of the network's contribution to learning and innovation in member organisations, the network learning effect (company level), and finally, the coherence between invested resources and outcome point to the solution that the Netgrow tool should be developed as an **input-output-outcome model**. This approach will also make it possible to integrate the concepts of additionality into the tool as well as taking the food sector's specificities into account. The outline of the prototype tool is presented in Chapter 6.

5.3 Expert evaluation of the tool (WP5 Workshop)

The overall results from the workshop supported findings from scientific literature, business literature, previous work in Netgrow, and added several requirements that are necessary to take into consideration when building a prototype tool. These requirements are summarised below.

Additional requirements and comments about the prototype tool from the workshop:

- A benchmarking approach had some advantages (rather simple to use) but certainly also disadvantages as not all parameters can be expressed in metrics.
- An input-output-outcome approach was more complicated to develop than a benchmarking tool, but the advantages of using the input-output tool were much bigger as it allowed to include a time dimension as well as to evaluate impact on society.
- A tool based on Best Practices would have a strong appeal among network managers, but the tool would be very indicative.
- The framework for the performance measurement (e.g. clear defined objectives and network strategy) should be coherent with the tool
- The tool needs to be equipped with indicators for hard and soft measures
- The tool needs to take into account the different dimensions of innovation and learning, including identifying the best proxies for measuring learning and innovation
- The tool must solve the challenge of how to assess learning
- The tool should include a time dimension, as performance is measured as changed performance over a time span
- The tool should be easy to use at network management level and easy to fill in (submit data) at member level

5.4 Potential beneficiaries of the tool

The users of the tool are foreseen to be network management, funding agencies and innovation intermediaries, and policy makers. A key point for applicability, hence success, of a performance measurement tool is that the results of the measurement can be translated into actions to improve performance. Therefore, the Netgrow tool will also include a List of Recommended Actions for

improving the network developed to meet the requirements of policy makers and of network management.

Network management has an obvious interest in monitoring the network's performance; both to keep members satisfied and to ensure that the network develops in line with its strategy. In the latter case the performance measurement must be carried out with a clear vision on the network's strategy, its goal, and its objectives. Concerning the former issue of keeping members satisfied, the performance measurement can contribute to give network management an indication of the degree of satisfaction. This is because the measurement of network performance at network level can only be done by aggregating data from members, and such data would provide information about the members' satisfaction with the network's activities, and the outcome of such activities.

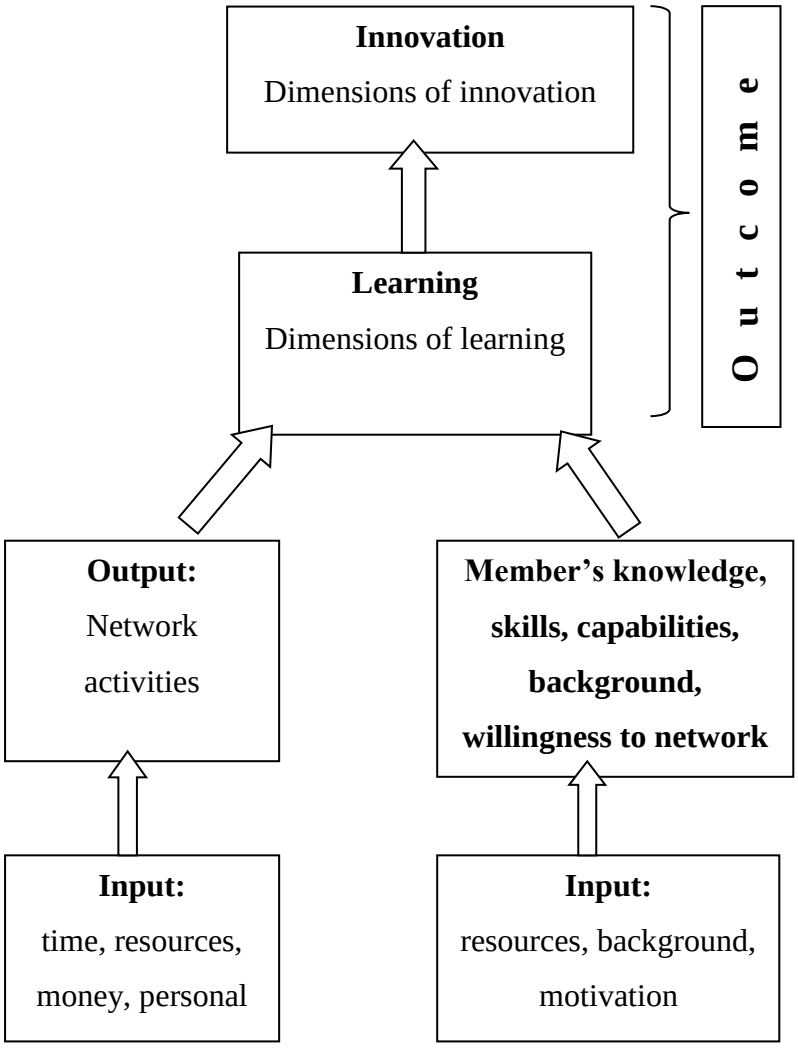
For companies, that spend time and money on participating in networks, an evaluation of the network's "quality" could be the driving factor for making a decision whether to participate in the network or not. Companies generally consider networking very positively (e.g. Kühne, Lambrecht et al., 2012), but when they are asked what they gained from their participation it proves them very hard to assess the outcome. Interviews with network participants in many EU countries and several non-EU countries support this statement.

6 Outlining the prototype tool

6.1 The prototype performance measurement tool

Based on the research and findings presented in the previous sections, it is decided to elaborate the prototype tool as an **input-output-outcome model**, with the purpose of measuring learning and innovation performance at the network level, as illustrated in Figure 9. The Netgrow tool will as such regard innovation as the outcome of learning, and the success of learning as dependent on the network's activities (matching the requirement of the members) and the skills and capabilities of the members (capabilities and skills required to learn, and in a long term view to innovate).

Figure 9: The Netgrow prototype tool for measuring learning and innovation performance at network level.



The main reasons for choosing the input-output-outcome approach are:

The network's performance (economic as well as learning and innovation performance) must be assessed in accordance with the network's framework conditions such as funding, strategy, competitive advantages and other external factors, and the specificities of the food sector.

The purpose of innovation networks is to "produce innovation" and this is in many networks the intended outcome of learning from the activities and exploiting the opportunities the network offer. Networks produce a (measurable) output such as conferences or projects, but the real outcome or impact from this output is potentially evident only at a later stage. Policy makers, funding agencies, network management, and (present and potential) network members all have an interest in the network's outcome; each of the key stakeholders with their own motivation such as use of resources, innovation support, reputation or overall impact on industry and society.

The model will allow the time dimension to be included and therefore have to an impact. The time dimension may be time from activity to exploited knowledge, or time from funding until the innovation is in the market,. Finally, the time dimension can be applied according to network age and life stage.

Measuring learning will prove very difficult. Initially, learning will be assessed in the model as measurable outcome (projects, patents etc), but the idea is to go deeper into the learning aspect at member level. This will be undertaken by investigating and measuring members' background knowledge, knowledge uptake and exploitation of knowledge.

The input-output-outcome model can be supplemented by other performance measurement tools after need.

The prototype tool will consist of the following elements:

A questionnaire focusing on quantitative indicators and measurements of performance and innovation and on qualitative issues related to learning, innovation and network participation (to be developed in WP6).

A data gathering template (interview guide) targeting network management. This guide will include questions demanding qualitative and quantitative answers about learning, innovation and the overall performance of the network, and issues about implementation of network strategy and goal fulfilment. (to be developed in WP6)

An approach to aggregating (primarily statistical data, but also data measured on e.g. Likert-scales) from member level into network level. This will depend on the formulation of the questions and use of scales; this will be determined in WP6.

A data gathering template targeting member level in the form of a questionnaire investigating knowledge uptake and exploitation (learning) from projects and activities. This template will be filled in at member level and processed to an aggregated network level. To be developed in WP6.

An approach to reporting the results from the above mentioned procedures including a network evaluation model inspired by the cluster evaluation model.

A list of recommended actions that can be imposed at network level to strengthen innovation and learning within the network.

A list of recommended actions that can be imposed at policy maker level to strengthen innovation and learning within the network.

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8 Appendix

8.1 Appendix 1: Suggestions for measurements / expressions for learning performance

Reference	Expression
Personal skills	
NETGROW	Obtaining job-specific information
NETGROW	Outcome quality of each activity
Korhonen	Continuous capacity to assimilate and construct new knowledge
Korhonen	The skill of being able to critically evaluate knowledge and its relevance
Schildt	Knowledge creation
Knowledge pool in the firm	
Schildt	The diversity and depth of knowledge acquired
Schildt	Simple, complex or tacit knowledge (has an impact on how easy knowledge is transferred)
Knowledge transfer and storage processes at firm level	
Schildt	Knowledge transfer or acquiring new knowledge (how to define?)
Best	Mutual exchange of tacit and explicit knowledge
Schildt	Knowledge creation
Schildt	Change in knowledge focus as collaboration matures
Schildt	Process for acquiring, transferring, sharing and exploiting knowledge
Schildt	Speed of integrating knowledge
Best	Organizational context conductive to enlarging individual perspectives
NETGROW	Enhancement of the firm's skills and capabilities
Schildt	Impact from competition between alliance partners on learning
Clarysse	The spill-over effect from participating in projects, alliances or networks (i.e. the firm's acquirement of information about new markets, new technologies or new routines)
Knowledge exploitation at firm level	
Schildt	Learning outcome (technological learning)

Schildt	Learning (in general) (how to assess?)
Clarysse	Ability to make changes in the firm's behaviour during or after a project (= behavioural additionality)
Clarysse	Input additionality (i.e. the effect of a public R&D grant on the firm's R&D expenditure)
Knowledge transformation in networks	
Korhonen	Integration of tacit knowledge into the learning process
Korhonen	Transfer of knowledge between groups in the network
Korhonen	Managing knowledge processes
Korhonen	Ability to create conditions that encourage creativity, learning, innovation and experiments
Korhonen	Transparency through knowledge-layers within the network
Korhonen	Combining knowledge creation and conceptualisation of knowledge
Korhonen	Ability to filter and process information / knowledge
Network's ability to act on new knowledge	
Korhonen	Ability to respond to changes in the network's environment
Korhonen	Commitment to continuous staff development

8.2 Appendix 2: Suggestions for measurements / expressions for innovation performance

Reference	Expression
Firm level	
Schildt	R&D intensity (R&D in % of turnover)
Clarysse	Extra internal efforts resulting from a grant that the firms puts into the innovation project (i.e. more internal R&D spending)
Clarysse	Extra outputs from the firm resulting from an innovation grant (i.e. more patents, more prototypes)
Clarysse	The additional output from an innovation project for the firm and / or for the consortium
Clarysse	Changes in firm behaviour during and after a project
Clarysse	Innovation output
NETGROW	Innovation uptake
NETGROW	Innovation at firm level
NETGROW	Innovation- not further defined
NETGROW	Innovation process
NETGROW	Product or process innovation success
NETGROW	Enhancement of effectiveness of R&D efforts
NETGROW	Return on investments in R&D
NETGROW	Improvement in performance
Kind	Profit improvement from innovation
NETGROW	Integration of business processes
Network level	
NETGROW	Market life of innovation outputs or projects
NETGROW	The network's market orientation ("brings hot topics to the table")
NETGROW	The network's ability to be at the forefront with news and intelligence
NETGROW	Member's satisfaction
NETGROW	Cost and duration of innovation transfer

NETGROW	Outcome of innovation funding
NETGROW	Innovation uptake
NETGROW	Network's involvement in the innovation process
Kind	Improved access to key industrial players
Kind	Access to funding
Kind	Interaction public and private stakeholders
NETGROW	Impact on the environment from innovations
Kind	The added value for the network from innovations
Kind	Impact from framework conditions on network's innovation
Kind	Assessments of impacts from non-monetary factors
NETGROW	Network's impact on members' innovation

8.3 Appendix 3: Innovation Measurement/Indicators

Inputs

Innovations – expenditures		
Indicator	**Measure**	**Source**
Expenditures on In-House R&D in 2010 only	€	Community Innovation Survey 2010
Expenditures on purchase of External R&D in 2010 only	€	
Expenditures on acquisition of machinery, equipment and software in 2010 only	€	
Expenditures on acquisition of other external knowledge in 2010 only	€	
Total Innovation Expenditure 2010	€	
R&D intensity (R&D expenditure as % turnover)		Oslo Manual (2005)
Current expenditure on in-house R&D		Business Expenditure on Research and Development (BERD) Survey 2009/2010
Labour costs (wages, salaries and all costs of personnel directly associated with R&D)	€	
Other current costs (materials, supplies and equipment, literature and subscriptions, overheads associated with R&D but excluding software and purchases of licences to use intellectual products for more than a year)	€	
Capital expenditure directly linked to R&D		
Land and buildings (sites for laboratories and pilot plants, buildings purchased, constructed and repaired directly for R&D)	€	
Payments made for licences to use intellectual products for more than a year	€	
Instruments and equipment excl. software (major instruments and other capital equipment acquired wholly for R&D purposes)	€	
Software Purchased (acquired wholly for R&D purposes)	€	
Software Developed by your Company in-house and used in-house (developed for R&D purposes)	€	
Breakdown of total in-house R&D expenditure		Business Expenditure on Research and Development (BERD) Survey 2009/2010
Basic research (experimental or theoretical work undertaken primarily to acquire new knowledge, without any particular application or use in view)	%	
Applied research (original investigation undertaken in order to acquire new knowledge, primarily directed towards a specific practical aim or objective)		

Experimental development (systematic work, drawing on existing knowledge gained from research and practical experience that is directed to producing new materials, products and devices, to installing new processes, systems and services, or to improving substantially those already produced or installed)		
Breakdown of total external R&D expenditure		
Related companies (parent, subsidiary, other affiliates)	€	
Non-related companies		
Government research companies		
Higher education institutes/universities		
Private R&D institutes/laboratories		
Other		
Total external R&D expenditure		

Financial innovation efforts*		
Indicator	**Measure**	**Source**
Product development	Indicative with regards to Structuredness of spending financial resources during year before observation period – 4-point scale with: 1) None, 2) According to needs, 3) Distinctively budgeted on project base, 4) Distinctively budgeted on yearly base)	**Adapted from:** Gellynck et al., 2007, Noronha Vaz et al., 2004, OECD, 2005, SMEs-NET Survey, 2005-2006
Process development		
Market research		
Organizational development		

*Truefood SME questionnaire conducted in WP5 "Improved marketing and food supply chain organization methods for traditional food products" with particular focus on measurement and scales applicability to SMEs (Kühne, 2011)

Source of funds for in-house R&D		
Indicator	**Measure**	**Source**
Own company/internal funds	€	Business Expenditure on Research and Development (BERD) Survey 2009/2010
Other companies (R&D performed on their behalf)		
Government grants for R&D		

Other public funding		
Higher education institutes		
Private non-profit institutes		
Other sources		
Total R&D funding		

Human innovation efforts*		
Indicator	**Measure**	**Source**
Courses and trainings	Indicative with regards to Frequency of spending time for improving human resources during the year before observation period on 7-point frequency scale (1:None, 2: Once a year, 3: Once in 6 months, 4: Once in 3 months, 5: At least once a month, 6: Once a week, 7: Several times a week)	**Adapted from:** Gellynck et al., 2007, Noronha Vaz et al., 2004, OECD, 2005, SMEs-NET Survey, 2005-2006
Self-study (reading professional literature)		
Seminars		
Fieldwork (e.g. study tours visiting other companies)		
Experimental trials		
Other		

*Truefood SME questionnaire conducted in WP5 "Improved marketing and food supply chain organization methods for traditional food products" with particular focus on measurement and scales applicability to SMEs (Kühne, 2011)

Number of staff involved in in-house R&D across gender		
Indicator	**Measure**	**Source**
PhD qualified researcher (researchers with a PhD level qualification)	Number of employees across gender (male, female, total, % time spent on R&D per category)	Business Expenditure on Research and Development (BERD) Survey 2009/2010
Other researchers (researchers with a non PhD level qualification)		
Technicians (technically qualified personnel e.g. lab. technicians, draughts people)		
Support staff (all other R&D supporting staff including R&D managers, administrators and clerical staff)		
Total R&D staff		

Creativity and skills		
Indicator	**Measure**	**Source**
During the three years 2008 to 2010, did your enterprise employ individuals in-house with the following skills, or obtain these skills from external sources?	Confirmatory – Yes/No	Community Innovation Survey 2010
Skills by source		
Graphic arts/layout/advertising	Confirmatory – by various sources (In-house, external, N/A)	
Design of objects or services		
Web design		
Market research		
Software development		
Multimedia (combining audio, graphics, text, still pictures, animation, video etc.)		

Throughputs

Product and process innovations – activities		
Indicator	**Measure**	**Source**
During the years 2008 to 2010, did your enterprise engage in In-House R&D	Confirmatory – Yes/No	Community Innovation Survey 2010
During the years 2008 to 2010, did your enterprise engage in purchase of External R&D		
During the years 2008 to 2010, did your enterprise engage in acquisition of machinery, equipment and software		
During the years 2008 to 2010, did your enterprise engage in acquisition of other external knowledge		
During 2008 to 2010 did your enterprise have any innovation activities that did not result in a product or process innovation because the activities were abandoned or suspended before completion		
During 2008 to 2010 did your enterprise have any innovation activities that did not result in a product or process innovation because the activities were still ongoing at the end of 2010		

Innovation – co-operation activities		
Indicator	**Measure**	**Source**
During the three years 2008 to 2010, did your enterprise co-operate on any of your innovation activities with other enterprises or institutions?	Confirmatory – Yes/No	Community Innovation Survey 2010
Type of co-operation partner by location		
Other enterprises within your enterprise group	Confirmatory – by	

Suppliers of equipment, materials, components or software	regions (Ireland, EU, US, China/India, Other)	
Clients or customers		
Competitors or other enterprises in your sector		
Consultants, commercial labs or private R&D institutes		
Universities or other higher education institutions		
Government or public research institutes		

Collaboration for innovation*		
Indicator	**Measure**	**Source**
Innovation collaboration of food manufacturer with supplier[$]	Joint activities for research and development – yes/no binary scale)	**Adapted from:** Batterink et al., 2006; Noronha Vaz et al., 2004; OECD, 2005
Innovation collaboration of food manufacturer with customer[$]		
Innovation collaboration of supplier with food manufacturer[$]		
Innovation collaboration of customer with food manufacturer[$]		

*Truefood SME questionnaire conducted in WP5 "Improved marketing and food supply chain organization methods for traditional food products" with particular focus on measurement and scales applicability to SMEs (Kühne, 2011)

[$]Indicates the collaboration for innovation between two chain members, whereby the first mentioned is answering whether he/she collaborates with the second mentioned, e.g. 'food manufacturer with supplier' refers to the answers of the food manufacturer towards his/her supplier

Outputs

Product innovations		
Indicator	**Measure**	**Source**
During the years 2008 to 2010, did your enterprise introduce new or significantly improved goods	Confirmatory – Yes/No	Community Innovation Survey 2010
During the years 2008 to 2010, did your enterprise introduce new or significantly improved services		
Were any of your product innovations during the years 2008 to 2010 new to your firm		
Were any of your product innovations during the years 2008 to 2010 new to your market		
Distribution of turnover in 2010 for new or significantly improved goods and service innovations introduced during 2008 to 2010 that were new to your market	%	

Distribution of turnover in 2010 for new or significantly improved goods and service innovations introduced during 2008 to 2010 that were new to your enterprise but not new to the market		
Distribution of turnover for goods and services that were unchanged or only marginally modified during 2008 to 2010 (include the resale of new goods or services purchased from other enterprises)		

Process innovations		
Indicator	**Measure**	**Source**
During the three years 2008 to 2010, did your enterprise introduce new or significantly improved methods of manufacturing or producing goods or services	Confirmatory – Yes/No	Community Innovation Survey 2010
During the three years 2008 to 2010, did your enterprise introduce new or significantly improved logistics, delivery or distribution methods for your inputs, goods or services		
During the three years 2008 to 2010, did your enterprise introduce new or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting or computing		

Market innovations		
Indicator	**Measure**	**Source**
During the three years 2008 to 2010, did your enterprise introduce significant changes to the aesthetic design or packaging of a good or service (exclude changes that alter the product's functional or user characteristics - these are product innovations)	Confirmatory – Yes/No	Community Innovation Survey 2010
During the three years 2008 to 2010, did your enterprise introduce new media or techniques for product promotion (i.e. first time use of a new advertising media, a new brand image, introduction of loyalty cards, etc)		
During the three years 2008 to 2010, did your enterprise introduce new methods for product placement or sales channels (i.e. first time use of franchising or distribution licenses, direct selling, exclusive retailing, new concepts for product presentation, etc)		
During the three years 2008 to 2010, did your enterprise introduce New methods of pricing goods or services (i.e. first time use of variable pricing by demand, discount systems, etc)		

Organisational innovations

Indicator	Measure	Source
During the three years 2008 to 2010, did your enterprise introduce new business practices for organising procedures (i.e. supply chain management, business re-engineering, knowledge management, lean production, quality management etc.)	Confirmatory – Yes/No	Community Innovation Survey 2010
During the three years 2008 to 2010, did your enterprise introduce new methods of organising work responsibilities and decision-making (i.e. first use of a new system of employee responsibilities, team work, decentralisation, integration or de-integration of departments, education/training systems, etc)	Confirmatory – Yes/No	
During the three years 2008 to 2010, did your enterprise introduce new methods of organising external relations with other firms or public institutions (i.e. first use of alliances, partnerships, outsourcing or sub-contracting, etc)	Confirmatory – Yes/No	

Product, market and organization innovation activities*		
Indicator	**Measure**	**Source**
Our company improved the packaging of our traditional product	Yes-No-Not applicable scale for introduction of innovation activities during the last 3 years	**Adapted from:** Avermaete et al., 2004, Gellynck et al., 2007, Lundvall, 1995, Noronha Vaz et al., 2004, OECD, 2005, SMEs-NET Survey, 2005-2006, Vermeire et al., 2005
Our company improved the quality of our traditional product (through selected ingredients, raw materials, better uniformity of the product etc.)		
Our company improved the convenience of our traditional product		
Our company entered new geographical markets for our traditional product		
Our company improved marketing activities for our traditional product		
Our company introduced new management tools		
Our company improved management practices of research and development		
Our company increased participation in networks		

*Truefood SME questionnaire conducted in WP5 "Improved marketing and food supply chain organization methods for traditional food products" with particular focus on measurement and scales applicability to SMEs (Kühne, 2011)

Innovation performance - financial		
Indicator	**Measure**	**Source**
New to market sales (% of turnover)	%	European Innovation Scoreboard 2009
New to firm sales (% of turnover)		
Non-R&D innovation expenditures (% of turnover)		

Innovation results - Extend of significant contribution of applied innovation activity to business success*		
Indicator	**Measure**	**Source**
Improving the packaging of our traditional product	To what extent do you agree that the following changes contribute significantly to the success of your company. (Please indicate only those areas what you applied above under innovation activities)	**Adapted from:** Gellynck et al., 2007, Noronha Vaz et al., 2004, Vermeire et al., 2005
Improving the quality of our traditional product (through selected ingredients, raw materials, better uniformity of the product etc.)		
Improving the convenience of our traditional product		
Entering new geographical markets for our traditional product		
Improving marketing activities for our traditional product		
Introducing new management tools		
Improving management practices of research and development		
Increasing participation in networks		

*Truefood SME questionnaire conducted in WP5 "Improved marketing and food supply chain organization methods for traditional food products" with particular focus on measurement and scales applicability to SMEs (Kühne, 2011)

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