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1. Problem Statement

Market orientation, initially framed by Peter Drucker in 1954, has drawn huge attention in the management literature. Its importance for successful innovation management and overall firm performance has been widely discussed. In this context food supply chains characterized by an high degree of complexity due to many partners from primary production until the supermarket shelf (Bourlakis and Weightmann, 2004) are increasingly depending on market orientation not only across the chain (Grunert et al., 1997). The horizontal chain perspective needs to be accompanied by a vertical view on the entire network. Following Lazzarini et al. (2001) the interorganizational relationships, "ties", between different network partners are of increasing importance to understand and model the complexity of the agrifood industry. Consequently market orientation not only has to account for the horizontal chain axis, but also for the vertical axis - the entire net agrifood companies operate in. Therefore, the necessity of all players in the netchain to engage in information sharing has become increasingly important and has lead to a new management function of "food (net)chain management". Thus, the aim of this paper is to explore a new construct what we call "food netchain orientation" resp. "netchain orientation". But what exactly is netchain orientation and how can it be operationalized in order to make it measurable, implement and improve it for todays ever increasingly complex agri-food chains?

Against this background this paper intends to builds on market orientation and extend it towards the food supply chain and network and therefore endorses the construct of netchain orientation (NCO). We strive to get more insights into how successful companies in the food industry employ NCO, .i.e. the degree to which partners in the chain are involved with knowledge sharing across the chain as well as with potentially different forms of collaboration. In oder to do so we build on the netchain approach established by Lazzarini et al. (2001) and further developed by e.g. Storer et al. (2003). Thus, by analyzing a sample of Dutch agri-food chains with respect to their innovation processes on firm (individual comany level) as well as on chain level (systemic innovations) and net level we attempt to identify characteristics of NCO in innovation management in the food industry. Therefore, this paper takes an exploratory approach since the goal is to detect new structures and principles which may lead to further theory development in the area of food innovation management. In doing so, this paper intends to categorize different items explaining different levels and modes of NCO and their impact on successful innovation management. This helps us trying to operationalize the theoretical construct of "netchain orientation-NCO", which is a precondition for successfull innovation management in complex agri-food chains. The challenges of building a NCO and define its scope (length, breadth and intensity) may be moderated by the following context factors: NCO may vary according to the degree of vertical integration, which influences the degree to which a partner in the very front end of the food chain has information about the back end - thus, affecting the demand chain management (Charlebois, 2008). NCO seems also to be influenced by the power distribution in the chain (see e.g. Hingley, 2005). Furthermore, different business strategies may require different approaches to developing a sufficient degree of NCO. To gain a better understanding of why and how companies manage to establish a NCO, this paper investigates a set of leading Dutch agro-food companies of different positions in different supply chains.

Literature on market orientation builds the basis for developing a framework for assessing netchain orientation. Hence, this paper seeks to contribute to the literature pertaining to market orientation in innovation processes in food supply chains (e.g. Beverland, 2005). Thus, this contribution delivers basic

insights into the question of how to implement a "netchain orientation" among the food supply netchain. Following the intention to better understand the characteristics of "netchain orientation" in a context of innovations in agri-food chains, we seek to contribute to different literature streams and draw on the market orientation, the chain and network orientation literature and the innovation management literature.

The remainder of this paper is organised as follows: Section 2 contains a brief literature review on current research on food innovation management and the need for increased NCO. This is followed by a description of the sample and the research strategy in section 3. The first empirical validation and further refinement of NCO is then given in section 4. In the then following discussion in section 5 the construct of NCO and important influence factors for establishing it receive more extensive exploration. Finally, drawing on these findings, Section 6 derives some conclusions, provides managerial recommendations, and also highlights areas for further research.

2. Current research on food innovation management research: Towards a measure for chain and network orientation

2.1. Innovation management in the food industry

The food industry is traditionally seen as a rather low-tech sector with limited R&D spending compared to high-tech industries such as biopharmaceuticals etc. (Menrad, 2004). However, technological social and market changes have increasingly shaped the innovative activities of food companies. The increased competitive pressure due to ever stronger retailers may be seen as an important competitive driver calling for increased product differentiation through food innovations. But there is also new technological knowledge which has led to new applications within the food industry. For instance, the emerging functional foods sector has drawn much attention in the past and has led to many innovative initiatives within the food sector (e.g. Stein and Rodriguez-Cerezo, 2008; Bröring, 2005). But also stricter government regulations concerning food safety have created new challenges the food industry has to cope with (Enzing, 2009). In summary, many different challenges have led to an increased innovative activity in the food sector. Therefore, knowledge about steps and level of chain and supply net is becoming increasingly important for each of the different players in the food supply chain (Bourlakis and Weightman, 2004). Referring to innovation management in the food industry, NCO seems especially important for those innovations, which do show a systemic character; thus, require many partners in the chain in order to make the innovation work (Bröring, 2008). In general, the food chain shows many interdependencies between buyers and suppliers during innovation processes (Bröring and Cloutier, 2008) that necessitate a stronger NCO during innovation processes as it is usually the case in other industries (Fortuin and Omta, 2009). The construct of NCO in innovation projects, thus, poses different question we seek to highlight in this paper.

2.2. Chain and network orientation in innovations in the food industry

Following the intention to better understand the characteristics of NCO in a context of innovations in agri-food chains, this paper integrates two different literature streams: it builds on the rationale for ***market orientation*** and applies it to the ***netchain*** described in the chain and network literature in order to better understand the importance and of ***NCO*** for successful innovation management – hence explores the new construct of "NCO" against the background of innovation management in the context

of complex agri-food supply chains and networks . Hence both the market orientation as well as the chain and network theory streams are needed to build a framework for comparing the levels and modes of NCO in different agri-food supply chains.

Before elaborating on potential measures for chain and network orientation in the food industry exploring what challenges firms face and how they develop to become more netchain oriented, a closer consideration of the definitions and characteristics of NCO is necessary. First of all, the construct of NCO can be derived from the supply chain orientation (SCO) literature, defined as an intrafirm adoption of a supply chain philosophy (Mentzer et al. 2001). The rationale behind SCO thus is, that a firm takes a systems approach, it looks at the entire chain instead of at fragmented parts. Moreover, it seeks synchronization of intrafirm and interfirms strategic and operational capabilities (as e.g ECR-strategies between retailer and food manufacturer). SCO, in turn, can be derived from the market orientation (MO) literature. This paper follows Narver et al. (2004), who define MO as a general approach toward running a certain business, underscored by the company's culture. Therefore, "*market orientation is the organizational culture that most effectively and efficiently creates the necessary behaviours for the creation of superior value for customers* " (Narver et al. 2004:p. 242). Kohli and Jaworski (1990) employ a behaviouristic approach and argue that MO is constituted by three dimensions:

1. **Generating market-related knowledge** about customers and competitors.
2. **Dissemination** of that knowledge inside the company.
3. The **ability to react** on the basis of that market knowledge and be consistent with the market concept.

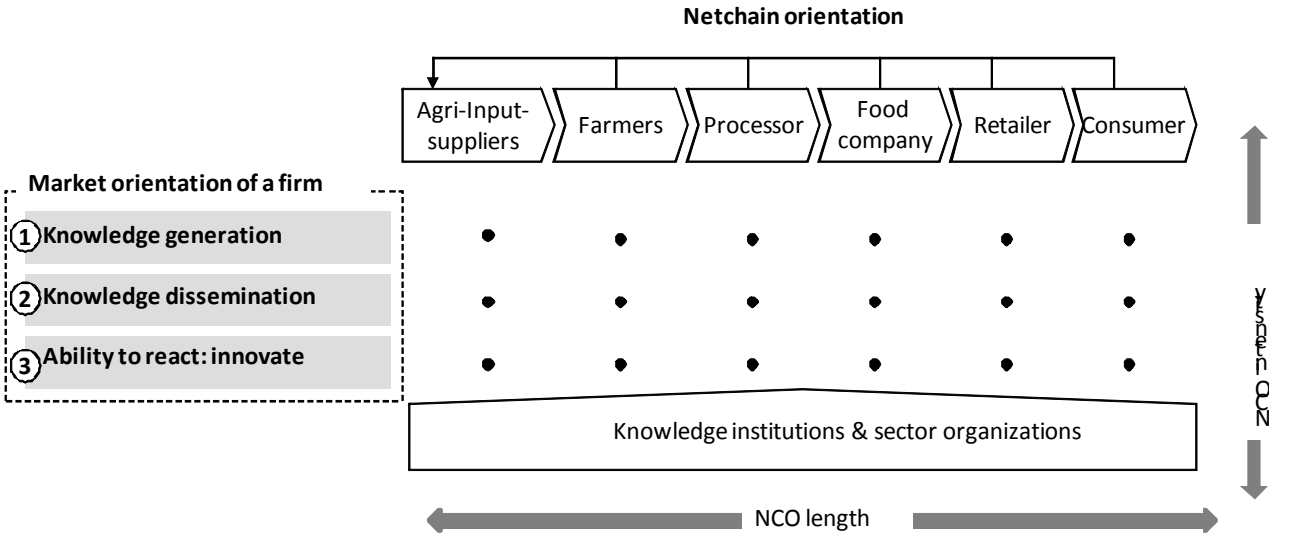
General agreement in MO literature indicates that ongoing, systematic information collection about customers and competitors, cross-functional sharing of that information in the company, and rapid responsiveness to competitor actions and changing market needs are at the centre. Narver et al. (2004) expand this definition of MO to feature pro-active MO. That is, MO would be reactive only if there were no anticipation of upcoming, evolving needs. Pro-active MO is especially important for the success of new products. Literature on MO is well established, initially postulated by Drucker in 1954. However, when it comes to apply MO to an entire netchain to build NCO, research on the how to establish and how to define and measure NCO is rather limited. Therefore, we start out with market orientation and apply it to the particularities of long supply chains operating in a larger net consisting of knowledge institutions and sector organization as given in the food industry.

As detailed in Fig. 1, a first step to measure NCO in the food supply chain can be built on the two dimensions:

(1) **Length:** how many partners are taken into consideration in NCO during innovation processes

(2) **Intensity:** in how far does the firm not only generate knowledge, but also disseminate and act on it (include chain related knowledge early in the front end of innovation (e.g. idea generation and evaluation).

Fig.1. Moving from market orientation to netchain orientation (NCO) in the food industry



Source: adapted from Bröring (2009)

To conclude, we conceptualize NCO as MO applied to the netchain with different characteristics in terms of NCO intensity (how intense is the generation of knowledge, its dissemination across the netchain and the ability to react) and NCO length, i.e. steps of the chain that are taken into account for MO. The next question to get a better insight into NCO takes into account situational factors to be discussed and framed in the following section in order to build a conceptual framework to better understand NCO.

2.3 Theory-derived conceptual framework for NCO and innovation performance

Supply chain management seems especially important for long and complex supply chains because value creation within the supply chain depends on how well each stage of the chain processes raw materials and information to add value for downstream customers (Manson et al. 2006). Therefore, the ***chain characteristics*** as the length of the chain and the degree of vertical integration do have an impact on market and NCO. On the horizontal chain axis this is because the supply chain configuration depends on the level of integration within the supply chain. According to Webster (1992), a supply chain can be characterised by different types of integration, reaching from pure transactional relationships to buyer–seller partnerships and strategic alliances to full vertical integrations. On the vertical axis the **network characteristics** also seem to have an effect on building NCO, as orientation towards the entire network seems to be a major task but may become rather difficult with increasing complexity of the network. We therefore simplify the network approach and only look at sector organizations and knowledge institutions resembling the network.

The relationship between market orientation and new product success seems contingent on the type of innovation (Lukas and Ferrel, 2000). In addition, extant literature argues that MO is positively influenced by supply chain management (Martin and Grbac, 2003). Thus, not only supply chain management itself, which refers to the way the supply chain is controlled to deliver on promises to meet customer needs, but also the different relationships in the supply chain (Trienekens et al. 2003; Trienekens et al. 2008), thus, the level of ***chain cooperation***, must be taken into account when analyzing MO. Strong supplier relationships positively affect the generation of market-related knowledge and more rapid responses to market information, allowing for improved customer responsiveness. Chain cooperation characteristics

are also affect by the power distribution in the chain (Hingley, 2005), as this may have an effect on the cooperation type and mode of communication in the chain.
Moreover, MO differs with respect to ***firm characteristics*** as, e.g. the chosen strategy type (Matsuno and Mentzer, 2000). Hence, MO and thus CO differ in prospector and defendor strategies (for the different strategies see Miles and Snow, 1978).

Fig. 2: Conceptual framework for innovation performance in complex agri-food chains

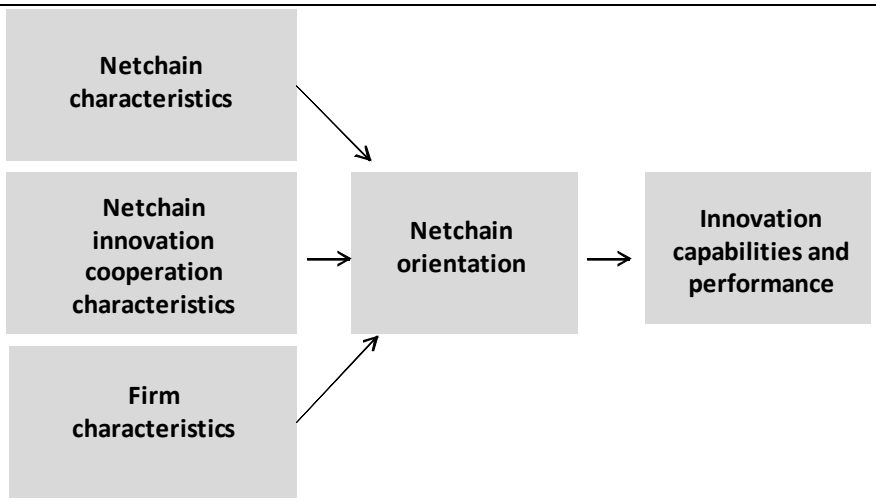


Fig. 2 shows the theory-derived conceptual framework. It illustrates that the right set of chain and network characteristics, together with the chain cooperation characteristics and individual firm characteristics are needed for NCO and ultimately for innovation performance of firms in complex netchains. Following the aim of this paper we used an empirical survey to get first insights on these three sets of characteristics and, more particularly, get an insight in which of these characteristics stimulate or hinder NCO in the complex agri-food netchains.

3. Methodology

3.1 Research strategy and design

Due to the paucity of prior research on innovations in supply chains and the special context of agri-food chains an exploratory research strategy has been adopted. The study is built on a literature analysis on innovation and chain management which is complemented by empirical data drawn from a survey on the Dutch agri-food industry. Since this paper is theory buildung taking a grounded theory approach, we did start with some pre-defined (theory derived) categories and applied them on the data to derive further insights on characteristics that may be needed for successful NCO. The study at hand, therefore, has to be seen as a preliminary study aiming at the generation of propositions for successful food NCO, that need to be operationalized in a future study with a richer data set allowing for hypothesis testing.

3.2 Sample

The theory-derived connectional framework for food NCO is complemented by first empirical data on food NCO originating from a survey on “systemic innovations” in the Dutch Agro-food conducted in 2002. The empirical data are based on the answers of 21 respondents, 11 stemming from Dutch multinational agri-food companies (market leaders in their field with superior innovative activity). As

detailed in Table 1 these companies take different positions in the chain (e.g. suppliers, processors or retailer). On the network level 10 network actors were included in the sample. These are stemming from governmental agencies, knowledge institutions and one independent consultant to the agri-food industry.

Tab. 1: Sample description

	Number of respondents	
Agri-food chain actors	**11**	
Suppliers		4
Processors		6
Retail		1
Agri-food network	**10**	
Sector organizations		4
Knowledge institutions		5
Consultant		1
Total	**21**	

4. Empirical insights into netchain orientation – a Dutch survey of food innovation

4.1. Netchain characteristics

The survey, first of all, did encompass a set of questions on the chain and network characteristics. Interestingly, in the category "*most important chain objectives and strategy"* the respondents valued quality goals and reliability of delivery higher than costs and information sharing. This implies that even for these market leaders of the Dutch agri-food sector which are the basis of the sample the level of NCO could be improved. May be related to this is the finding that speed and flexibility is valued lowest of all aspects. Questions regarding the item *"chain leader"* and the *"innovation leader"* also provided interesting results. While the retail sector was clearly regarded as the most important chain leader, it clearly refers to its gatekeeper role to the end-consumer, while the food processor is clearly seen as the source of innovation, thus, the innovation leader in complex agri-food supply chains. Nevertheless, both parties are important for innovation success, each getting 33% of the counts as the most important supply chain actor for innovation success. Regarding the important topic of *"sustainability improvement"* it was clear that the primary responsibility for e.g. pesticide and fertilizer use and animal welfare is located at the farm level, as about 64% of the respondents indicate.

An important indicator for NCO is the level of *"chain communication"* among the chain and network partners. It seems that in particular the level of knowledge generation of the construct market orientation is high in our sample. The respondents indicate to communicate with their main buyers on average once every two weeks. The contact with the main suppliers is comparatively low with once every month. On the network level, as can be expected for prospector companies, the contact with knowledge institutions is high, on average very two weeks there is contact. The communication with the sector organisations is not very high, the respondents indicate to have contact once every quarter.

Tab. 2: Netchain characteristics of the sample

Most important chain objectives and strategy	
- Quality	27%
- Reliability	22%
- Costs	17%
- Information sharing	17%
- Speed and flexibility	8-9%
Chain leader	
-Retail	43%
- Food processor	29%
Innovation leader/Source of innovation	
- Food processor	60%
Importance of retail and food procesor for innovation success	
- Retail and food processor	Both 33%
Sustainability improvement	
- Farm level	64%
- Food processor	18%
Netchain communication	
Main buyers	Every week
Main suppliers	Monthly
Knowledge institutions	Every two weeks
Sector organizations	Every quarter

4.2 Netchain and innovation cooperation characteristics

The potential influences of netchain and innovation cooperation characteristics on NCO are shown in Table 3. For instance the category *"most important chain cooperation objectives"* clearly shows how important NCO has become for innovation performance.

As shown in Table 3 in 45% of the incremental and 55% of the radical innovation projects are conducted with other partners in the supply chain. This clearly shows the great importance of NCO in complex agri-food supply chains as was already indicated by Bröring (2009). The most important "*innovation partners*" are knowledge institutions with 25%, but also buyers and machine supplies and even competitors are indicated as important cooperation partners. Recently, also the influence of ingredient suppliers has increased as well (Enzing, 2009). Also the *"duration of cooperation"* is remarkable, 30% of the collaborations have a duration of well over 10 years. It is clear that companies more and more concentrate on their core capabilities, while sourcing expert knowledge externally. Chesbrough (2003) has coined the term open innovation for this phenomenon. He refers mostly to high tech sectors. Our results indicate that also in low- to medium-tech sectors such as the agri-food industry this phenomenon is of great importance.

Tab. 3: Netchain and innovation cooperation characteristics of the sample

Types of innovation in netchain cooperations	
Incremental innovation projects	45%
Radical innovation projects	55%

Innovation partners	
Average number of external partners	2
Main buyers	20%
Machine suppliers	15%
Competitors	15%
Ingredient suppliers	5%
Knowledge institutions	25%

Main reason for cooperation	
Insourcing of expert knowledge and co-development of new knowledge	Both 65%
Market development and food safety	Both around 10%
Sharing of development risks and costs	5%

Duration of cooperation	
> 10 years	30%
3 < x < 10years	55%
< 3 years	15%

Legal form of innovation cooperation	
Contract	75%
Consortium	12%
Joint venture	12%

Contract specifications	
Division of roles, risks and returns	100%
IP protection and secrecy	95%
Management and governance, way of dealing with potential conflicts of interests	65%

Main challenges of innovation cooperation	
Conflicts of interest	25%
Unequal division of costs and benefits	15%
Dependency of one (or more) of the partners	15%
Problems with trust	10%

Moreover, regarding the "*legal form of cooperation*" our study indicates that 75% of all chain cooperations are based on contracts. In these contracts IP protection and the investments and risks of the company and the other partners are laid down. This helps to prevent the *"main challenges of cooperation"* such as conflicts such due to unequal division of costs and benefits, as mentioned in Table 3.

4.3 Firm characteristics

The empirical results concerning firm characteristics are summarized in Table 4 below. It shows that the companies have a high degree of internationalization and are world leading multinationals with average operating profits of 4%, while 67% of their sales volume is generated outside the Netherlands.

Tab.4: Firm and innovation characteristics (suppliers and agri-food processors)

Firm characteristics	
Operating profits	4%
Perc. international sales	67%
Innovation strategy	
Prospector strategy	90%
Innovation in strategic plan	65%
Primary innovation objective	
Increase profits	20%
Increase market share, product quality, product assortment, food safety	All around 10%
Entering new markets (radical innovation projects)	7%
Sustainability goals (e.g. environment and working conditions)	5%
Innovation input	
Average annual innovation expenditures	€ 11 million
Spending on radical innovation projects **(>** € 400.000/project)	40%
Innovation output in the last 3 years	
Number of innovations	13
Number of patents	7

Referring to *"innovation strategies",* with a share of 90% the sample clearly can be classified as mainly consisting of prospector companies. Whereas 65% of the companies have included innovation in their strategic plans. However, only 7% of the companies indicate that entering new markets is their primary R&D priority. Increase of profits, market share, product quality, product assortment and food safety are more general priorities. The *"innovation input"* shows an average R&D (Research and Development) expenditure of € 11 million. About 40% of the R&D is spent on radical innovation projects with a capital expenditure of over € 400.000. As can be expected for prospector companies, the average *"innovation output"* of the sample is impressive, with about 4 innovations and 2 patents per year.

Table 5 shows the innovation capabilities. These encompass the innovation techniques, the (tacit) knowledge and the management systems that are in place to use these techniques and specialist know how effectively. As can be expected, the relatively high level of market orientation of these prospector companies is reflected in the fact that about 60-70% of the companies make use of marketing techniques. However, interestingly, only 15% of the companies make use of marketing techniques in an early phase of innovation and only 5% make use of business unit funding or other techniques to improve business needs orientation. Apparently, even in these prospector companies the R&D-marketing interface still needs improvement. The stage gate model with clear go-no go moments is used by more

than half of the companies to shorten throughput times, while crossfunctional communication in R&D projects has an average frequency of once per month, interesting is that increasingly, next to product development and marketing, also manufacturing, quality, finance, ICT and purchasing take part in the project team meetings. From a NCO viewpoint it is interesting to notice that co-innovation with buyers and suppliers is becoming more frequent, about 1-4 to 1-3 of the innovation projects is conducted together with buyers, while in 5% to 20% of the innovation projects also buyers are incorporated.

Tab. 5: Innovation capabilities and performance

Innovation management techniques: ideation Phase	
Life Cycle Assessment, Quality Function Deployment	20-25%
Delphi	10%
Market research in early phase of innovation	15%

Innovation management techniques: screening phase	
Project management, well organized innovation process (e.g. clear stage gates)	55%
Marketing: concept and market testing, focus groups	60-70%
Steering on KPIs	25%
BU funding and focusing innovation on business needs	5%

Frequency of project team meetings	
Weekly	7-12%
Monthly	53-56%
Quaterly	25-40%
Once every half year	0-6%
Average number of participants	6

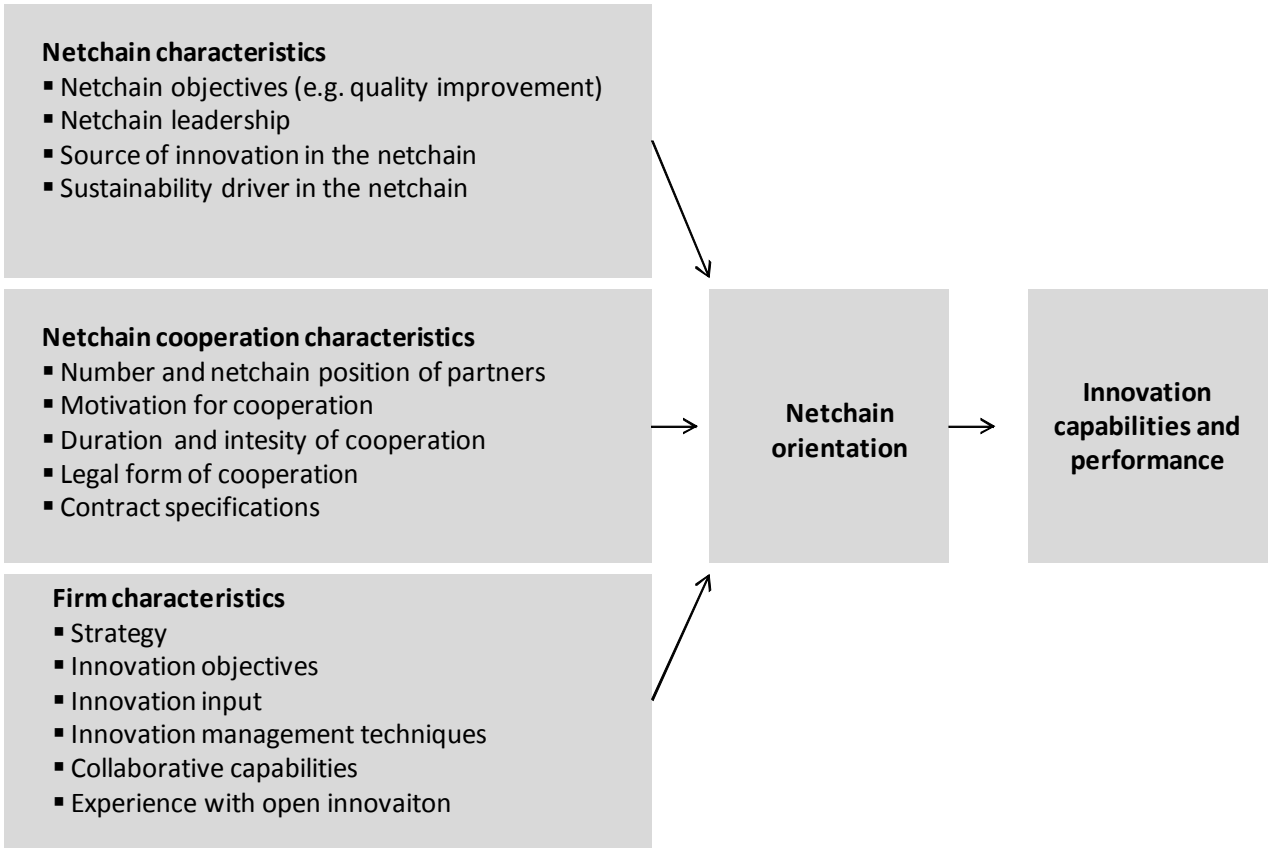
Cross functional participation in radical innovation projects	
Product development, marketing and sales	70-95%
Manufacturing and quality	40-50%
Finance and ICT	20-35%
Purchasing	5-20%

Co-innovation with buyers and/or suppliers	
Suppliers	20-35%
Buyers	5-20%

5. Discussion

As the empirical sample of leading Dutch agri-food companies has shown, there first of all seems to be a relation between NCO and innovation performance as the companies show characteristics of NCO (e.g. information generation, dissemination and innovation across the chain). NCO seems to be influenced by the three main dimension chain and network characteristics, chain cooperation characteristics and individual company characteristics. Even though, these three influence factors needs further empirical validation, the empirical results presented in section 4 allow for a first identification of items describing these three dimensions.

Fig. 3: Detailed conceptual framework for NCOin complex agri-food chains



As illustrated in Figure 6 four different **chain and network characteristics** need to be taken into account when analyzing the influences of chain characteristics on building NCO needed for successful innovation management. First of all, the overall "*chain objectives"* need to be clarified. Furthermore, it is important to make explicit which partner in the chain takes *"chain leadership"* and at which stage of the chain are the *"sources of innovation"* rooted, hence, who takes the *"innovation leadership"* role in the chain.

When it comes to chain **cooperation characteristics**, NCO seems to be influenced not only by the *"number of partners"* in the netchain, but also by the *"individual objectives"* of the partners for cooperation. Moreover, the characteristics of the cooperation itself need to be looked at in order to better understand influences for NCO. Thus, the *"duration and intensity of cooperation"* may seem to play an important role for knowledge generation and dissemination across the chain. This is also affected by the *"legal form of cooperation"*, hence, the applied policies governing IP issues among partners in the chain.

When analyzing NCO on the individual company level, we identified six different items of **company characteristics** of importance for NCO. As illustrated in Figure 3 these reach from “innovation strategy”, “innovation capabilities” to “collaborative capabilities” and “experience with open innovation”.

6. Conclusion

The analysis of the leading companies in the Dutch agri-food chain has allowed us to come up with a preliminary framework to assess the construct of NCO. This framework can be applied to first of all assess the characteristics of the chain and network structure, the type of chain cooperation and then helps to create awareness for NCOon company level. By analyzing a sample of leading Dutch agri-food companies we have been able to identify different items for “netchain orientation”. We could expect that different chains may be able to learn from each other using our framework to analyse their degree of NCOin innovation management in the future. However, this study is based on an undifferentiated survey of a set of agri-food companies without delineation among the companies (e.g. company types) and potential chain differences. Further substantiation of our framework clearly would require a larger quantitative study that also takes into account the particularities of different chains.

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