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Submission to track (III) Firms: innovation management in transition

Title: The dilemma of competition versus collaboration in collective system building

by Julia Planko, Utrecht University

1. Introduction

The implementation of innovative sustainability technologies in society is necessary to abate climate change. However, the implementation of such technologies often fails (Hargadon, 2010; Jansen, 2003). To increase chances of market success, firms can strategically build-up an innovation system or business ecosystem around their innovative technology (Berkhout, Hartmann, Duin, & Ortt, 2006; Kamp, 2008; Musiolik, Markard, & Hekkert, 2012). Transition literature refers to this process as 'system-building' (Musiolik et al., 2012), or, as it is usually carried out by networks of innovating firms, 'collective system-building' (CSB). Key strategic areas in CSB are the development and optimization of the new technology, the stimulation of socio-cultural changes as well as the creation of a market for the technological innovation. Moreover, to accelerate system-building processes, the different firm's system-building actions have to be coordinated (Planko, Cramer, Chappin, & Hekkert, 2016). When engaging in collective system-building, firms face a profound dilemma that may hamper collaboration: should they invest their limited resources into collaboratively building up the innovation system, or should they invest them into competing against their rivals for market share? On one hand, without the build-up of a favorable innovation system, their technology may fail from the start, for example because of a lack of infrastructure, supportive regulations or user awareness (Van de Ven, 2005). On the other hand, investing most resources into their own technology development may lead to competitive advantage and more market share (Van de Ven, 1993). However, if there is only a small market (or even no market at all) for the new technology, also a big market share of that small market may not be sufficient for the firm to break-even and prosper. Therefore, firms have to carefully weigh the advantages and disadvantages of collaboration versus competition when engaging in collective system building. The transition literature has not addressed this dilemma yet. To fill this gap in the transition literature, we use insights from the coopetition literature. The coopetition literature addresses the issue of simultaneously competing and collaborating with a partner (Ritala, 2001). However, the empirical context of most of the coopetition literature studies are dyadic relationships between firms in established industries (Dahl, 2013). This is in contrast to collective system

building, which usually takes place in networks of firms (three of more firms) in emerging industries (Musiolik & Markard, 2011).

The **aim of this paper** is to explore and gain insight into the dilemma of cooperation and competition in the context of collective system building by applying coopetition literature concepts to CSB. Our **research question** is: How do firms deal with the dilemma 'collaboration versus competition' when engaging in collective system building?

The empirical case chosen for this study is the case of the Dutch smart grids sector. Smart grids are not one technology, but many highly intertwined technologies. The development and implementation of smart grids requires intensive collaboration between horizontal and vertical actors along the supply chain. At the same time, these actors have to compete against the incumbent fossil-fuel based regime. That is why it makes it an especially interesting case for transition studies in general and collective system building in specific. It gives special insights into how collaboration under high uncertainty and with the pressure of an incumbent regime takes place. It can be compared to silicon valley twenty years ago: highly-driven entrepreneurs and intrapreneurs who collaborate very closely - while remaining competitors - to advance a technology. Observing entrepreneurs in the ongoing process of system building at a time that the new sector emerges promises to generate interesting insights into a new way of organizing business activities. We will examine how these actors organize their collaboration and minimize inherent risks.

The theoretical contribution of this paper is the application of coopetition literature to transition studies. We hope to show that the concept of coopetition also holds for system-building networks. And we want to shed light on the dilemma of cooperation versus competition, which is yet understudied in the transition literature. In addition, we might contribute to the coopetition literature, as it focuses on dyadic relationships so far, and we may be able to contribute with insights regarding coopetition in networks of firms.

The paper also aims to make a practical contribution. Practitioners who want to build-up a favorable ecosystem around their innovative technology can benefit from the insights this paper generates. Being more aware of potential benefits and risks can help innovative firms to make more educated choices with regard to collaboration with their competitors. If they better understand these benefits and risks they may be more prone to collaborate on collective system building.

2. Brief theoretical background

The coopetition literature is a strategic management field occupied with the phenomenon of firms who simultaneously compete and collaborate with each other (Ritala, 2001). Firms in focus here are rival firms offering similar products. They cooperate in some activities - usually upstream the value chain, e.g. R&D - and compete in others - usually downstream, closer to the customer, e.g. sales (Bengtsson & Kock, 2000). Coopetition literature has generated valuable insights into potential benefits and risks of collaboration between competitors. Benefits can be: Firms' resources and capabilities can be combined and used in competition against other clusters; firms complement and enhance each other in different areas (production, introduction of new products, entry into new markets); larger pool of knowledge; reduction of firm costs and risks (risk sharing); shortened lead times; knowledge sharing between rivals can help a firm shape the institutional environment in favor of its own technological design; potential to create more value as network than firms could do individually (Bengtsson & Kock, 2000; Liu, 2013; Ritala & Hurmelinna-Laukkanen, 2009; Ritala & Sainio, 2014). Risks can be: If actors don't compete, firms are less innovative; hampers anti-trust law; loss of first mover advantage; risk of short-term opportunistic behavior by rivals; risk of knowledge leakage; risk of losing ideas to competition; coordination costs - failure to coordinate independent firms; agency costs - failure to align operations at the alliance level with long-term goals of the parent firm (Bengtsson & Kock, 2000; Liu, 2013; Ritala & Hurmelinna-Laukkanen, 2009; Ritala & Sainio, 2014).

Moreover, the coopetition literature identified several necessary "facilitators of collaboration" between rivals: equal distribution of power and control between partners; sharing of financial risks; tacit agreement that collaboration stops when the market has been developed; and the presence of a neutral organization or association which controls and manages collective activities (Dahl, 2013; Ritala & Sainio, 2014). These conditions help to overcome difficulties and to reap the advantages of collaboration.

3. Research design

To answer our research question, we conducted a case study (Yin, 2009) in the Dutch smart grids sector. The Dutch smart grids sector was chosen because it is an emerging industry, and because smart grids can be classified as innovative sustainability technology. The sector is characterized by close collaboration between actors across the sector (Interreg IVB, 2011; NL Agency, 2012a, 2012b). Its key actors are aware that they need to collaborate to build up a favorable ecosystem for the smart grids technology to thrive in, and they have to overcome an incumbent technological regime

(Planko et al., 2016). Actors act under high uncertainty in a quickly changing emerging sector. This is what makes the smart grids case an especially interesting case to study transitions and collective system building. The Dutch smart grids sector is one of the front-runners globally. They were the first to implement a full-scale pilot project, which includes all actors along the value chain, including consumers. Many actors are active in this sector, and they collaborate closely in networks.

In a pre-study we identified the most important national networks in the Dutch smart girds sector. We did this by asking key actors of the Dutch smart grids field, e.g. spokespersons at national smart grids conferences, and smart grids experts from industries and research institutes. The outcome was a list of six networks. Of each network, we interviewed 3-4 key actors. That way we ensured that actors with of all types of system-building objectives (socio-cultural changes, technology development and optimization, coordination of the field, market development) were represented in our study. We stopped interviewing more actors when we found our data was saturated. The interviews were semi-structured and were conducted face-to-face. Each interview took 60-100 minutes. For reliability, this study employed a semi-structured interview protocol to ensure that interviews were consistent. Interviews were transcribed and analyzed with Atlas.ti software. Data was coded according to risks and benefits as well as facilitators of coopetition as based on literature.

4. Findings

Collective system building in the Dutch smart grids field takes place in networks of three or more firms. Our study showed that all interviewees understood that collaboration, even amongst competitors, was essential to build-up the innovation system. They are aware that they are not able to do this individually – no firm has sufficient resources to do so. Furthermore, CSB activities are conducted collectively, but in different constellations of actors. It is not possible for one network to conduct all CSB activities. Depending on the type of activities, different resources, expertise and/or abilities are required, so different types of networks are needed to successfully carry out these activities. For example, technology optimization and development is rather carried out by private-driven networks, whereas coordination activities are rather carried out by public-driven networks (which again involve company actors).

With regards to benefits, risks and facilitators of collaboration, a number of findings have been made. Table 1 shows the concepts from the coopetition literature in column 1, regarding benefits and risks of collaborating with competitors and facilitators of collaboration (i.e. factors that facilitate collaboration). Column 2 shows how actors in these networks deal with these issues.

From coopetition literature	***Smart grids case findings***
Benefits of coopetition	
Firms' resources and capabilities can be combined and used in competition against other clusters	This is definitely the case; firms bundle forces in pilot projects, in terms of physical materials, financial resources and in-kind contributions; high degree of knowledge exchange; financial and in-kind contributions for lobbywork
Firms complement and enhance each other in different areas (production, introduction of new products, entry into new markets)	Definitely. Firms exchange knowledge, co-develop products and services; come up with a vision for the new sector, design standards
Larger pool of knowledge	Definitely. Firms know that they have to collaborate to develop sufficient knowledge on the new technology, "no company can do it alone"; especially since technologies are highly intertwined and very different expertise is necessary (IT, hardware…)
Reduction of firm costs and risks (risk sharing)	Definitely. Costs for full scale pilot projects are very high, are shared by participating firms; R&D costs shared (as collaborate on technology optimization); by sharing these costs, they also share the risk (of losing these investments)
Shortened lead times	Definitely. One firm could impossible develop this technology (set of technologies), or it would be an extremely lengthy project. On the other hand, if too many actors are involved, there can be many conflicts or unclear direction. In that case it can result in longer lead times. Therefore it is important to have a network (collaboration) that is big enough to gain sufficient resources, but small enough to be manageable and efficient.
Knowledge sharing between rivals can help a firm shape the institutional environment in favor of its own technological design	Definitely. Without knowledge sharing in the uncertain environment of smart grids there couldn't be a common vision. This common vision allows firms to 'develop in the same direction' and to develop standards and compatible products and services. This is the basis for shaping the institutional environment. Moreover it a common vision is the basis to influence policymakers (lobbying).
Potential to create more value as network than firms could do individually	Definitely. "No firm could do this alone". Firms are aware they need each other. They probably would not even be able to create value individually.

From coopetition literature	*Smart grids case findings*
Risks of coopetition	
If actors don't compete, firms are less innovative	Interviewees agreed. Collaboration is necessary, but they said a certain amount of competition is necessary to stimulate innovativeness and product optimization. If more firms (or more networks of firms) do R&D, there will be more ideas generated and then the best one will hopefully become the dominant one (not always the case, ex.video systems). Despite this fact, collaboration is necessary to build up the new technological system. Even when collaborating, competition is good in the idea generation stage and, at a later stage downstreams the value chain when it comes to product diversification.
Hampers anti-trust law	Not the case in SG field (yet?)
Loss of first mover advantage	Theoretically that is the case, but entrepreneurs are aware that if they do not collaborate there probably will not be a market. Not sharing all their information can help them to stay competitive.
Risk of short-term opportunistic behavior by rivals	This hasn't been mentioned. They do not perceive this as risk. But this is because they take precautions. They do not share all their information. Also, most of the networks are based on previous collaboration (the firms had previous relationships/knew each other). In some cases collaboration agreements are signed. If there was threat of a free-rider, this was solved by private talk with this person/company. In another case a substantial membership fee was introduced to the network, so that only the very motivated firms stayed.
Risk of knowledge leakage	This was not perceived as risk by interviewees. However, it turned out that they don't perceive it as risk, because they take precautions to minimize/eliminate it. One way is to pick partners that they trust. Then, they do not share all their information completely. Moreover, they make agreements as "What is discussed in project stays in project". This is important, since all of them also collaborate with other firms on other projects. If they would share this knowledge with other partners (outside the project), the knowledge would quickly spread throughout the whole industry. This would make firms reluctant to share information at all. Knowing that the information stays only in the project reduces the perceived risk of knowledge leakage. Another mechanism in a network that developed knowledge was that for the pilot projects, which this network conducted, constellation of actors (firms) were chosen per pilot that were not direct competitors. While there were direct competitors in the network, two direct competitors did not work in the same pilot project. This enabled the firms per pilot to share knowledge relatively openly. At the end of the pilot projects, outcomes were shared among all members. This enabled firms to exchange knowledge, learn from each other and develop a vision, while at the same time not having to expose one's core knowledge to direct competitors.

Risk of losing ideas to competition	Actors were aware that they need to share ideas in order to build the system, as they need to come up with a vision together and they need to standardize technology and co-create compatible products and services. They know that herefore idea sharing is necessary. Also, they feel like pioneers in a new field, and they know they have to develop a very good technology together to be able to compete with the incumbent regime. Which again required idea sharing. Many of them supported or desired open innovation platforms. The sharing of ideas in this stage is considered very necessary, and they know that through sharing them they can develop and optimize their ideas. They need each other's expertise for that. What further helped were clear boundaries to information sharing. They do not share all their knowledge and ideas and moreover they make sure to only share them with selected partners.
Coordination costs - failure to coordinate independent firms	This was perceived as a risk. However, actors were aware of the need for coordination. A degree of coordination took place by organizing themselves in networks to reach system-building goals. Within these networks, coordination mechanisms, such as governance structure, definition of a common goal and task distribution help to coordinate independent firms. The generation of a shared vision helps.
Agency costs -failure to align operations at the alliance level with long-term goals of the parent firm	This was perceived as a risk, but rather in the opposite way: that companies might fail to align their own goals to system-building goals. The interviewees who were active in the smart grids fields were often intrapreneurs in bigger companies, trying to diversify their business. These visionaries had in mind that the technological regime will change, and understood that their companies should therefore also change in the long run. This vision was not always shared in a broad way within the companies. It could lead to conflicts between individuals within the firms (a different type of cost?): That the goals of the parent firm were not always aligned with alliance goals. Interviewees solved this by "wearing different hats". The intrepreneurs were aware that for their companies to sustain in the long run, building this new energy system was necessary, and they had neglect a short-run firm perspective, but instead take on a long-run system perspective when taking strategic decisions within their system-building networks/ alliances.

From coopetition literature	*Smart grids case findings*
Facilitators of collaboration	
Equal distribution of power and control between partners	Fair distribution of power is important, but fair does not necessarily mean power distribution needs to be equal; it depends on the resources a firms brings in. If there is a bigger firm which can and does contribute more resources (financial and in-kind) than other firms, the other firms accept that this firm has more power, e.g. provides chairman of the network or has more voting power. Actors understand that it is important to have both smaller (often have more ideas and can act quicker) and larger (more resources and political influence) firms in a network/collaboration/partnership. Some networks officially solved this by introducing different membership fees. Firms which pay higher membership fees get more voting rights and a seat in the board of directors.
Sharing of financial risks	This was mentioned as a very important facilitator of collaboration. In one of the networks the introduction of a membership fee served as breaking point: the less motivated members discontinued the collaboration. This limited the risk of free-riders, and decreased tensions within the network. The membership fees or other required financial contributions ensured that only motivated members joined or stayed in the network. Also, a network which was driven mainly by subsidies did not show as good results.
Tacit agreement that collaboration stops when the market has been developed	In the smart grids sector (amongst the interview partners), there was not necessarily an agreement to stop collaborating once the market is developed. Many of the technologies are interwoven, and actors need to collaborate closely also once the technology is optimized and once markets are developed. Also direct competitors did not plan to stop collaborations once the market is developed. However, they plan to diversify their end products from those of their competitors. I.e. once the market is developed, they expect a higher degree of competition and less collaboration. But they do not expect the collaboration to stop. They know that they still have to compete with the incumbent regime, and that they grow by sharing knowledge and resources.
Presence of a neutral organization or association which controls and manages collective activities	The presence of a neutral organization or association to manage collective activities was seen as very important for most system-building tasks. Depending on the CSB goal a network was striving for, the presence of a neutral leader was seen as essential, to ensure that not one company acts opportunistically. However, it was not necessary for every network (CSB objective) that a neutral organization was established. Sometimes the hiring of one external (non-member-firm) person was sufficient. In other cases the person in charge of the network was considered independent enough to act in favor of all parties in the network, even if it was a member-firm-employee (then the firm was a powerful actor

	with transition as objective…). In addition to a neutral leader, a participatory leadership style was seen as facilitating factor for collaboration. When each member firm's representative had enough freedom to bring in his ideas and expertise, the collaboration was considered most fruitful.

Table 1: Findings on how system-building networks in the Dutch smart grids field conduct coopetition.

5. Discussion and Conclusions

The benefits of coopetition described in the coopetition literature also hold for system-building firms. With regards to the risks, interviewees often stated that they do not perceive collaboration as risky at all. But when inquired further it turned out that actors take precautions from the start of the collaboration, or even beforehand, to prevent risks. That is why they do not experience that they are at risk when collaborating. They use 'coping strategies'. These coping strategies include the careful selection of collaboration partners, not sharing all confidential information completely, and moreover establishing very clear boundaries for the sharing of information. If there was a threat of a firm free-riding, this was solved by a personal talk to the representative from this firm; or by introducing a substantial membership fee to the network. This membership fee ensured that only the motivated firms who actively contributed stayed in the network, and potential free-riders left. This can be connected to the facilitator 'sharing financial risks', which is mentioned in the coopetition literature. Also for sytem-building firms, financial contributions enable better collaboration. Moreover, one network in our study was financed via subsidies, and interviewees claimed that these subsidies reduce the motivation of firms to perform as best as possible. This finding supports the argument that financial contibutions facilitate coopetition. Furthermore, interviewees were also aware of the risk cooridation costs, and minimized it by introducing structures to their collaboration that facilitated the coordination of their collaboration. They introduced clear governance structures, decision-making mechanisms and task-distribution systems.

Regarding the facilitators for collaboration, we found slight differences between the coopetition literature and our empirical data. The coopetition literature states that equal distribution of power and control was important to facilitate collaboration. Our findings showed that in CSB, actors find it important to have fair distribution of power and control, but they do not require it to be equal. It is accepted that bigger firms who contribute more resources in-kind and financially, have more power and control within the networks. This difference might be occur because the system-building firms know that for system-building the collaboration between smaller and larger firms are

important, and the dyadic relationships which are the empirical cases in the coopetition literature are usually between similarly sized competitors (e.g. two breweries sharing a bottle collection system). Another facilitator described in the coopetition literature is the presence of a neutral organization or association which controls and manages collective activities. In the system-building networks in the smart grid sector, a neutral entitiy to control and manage collective activities was also considered essential. However, this entity did not necessarily need to be a neutral organization. In some cases it was sufficient to hire a neutral external employee. Sometimes it was also acceptable that one of the employees of a member firms took on the coordinating role, if he was trusted to be neutral enough and act according to the system-building goals of the network and not according to his own company's goals. The tacit agreement that collaboration stops when the market has been developed, which is portrayed as facilitator for collaboration in the coopetition literature, was not prevalent in the system-building networks. Since in the smart grids sectors many technolgies are intervowen, firms plan to collaborate also after the market has been developed. However, they plan to diversify their products for end-customers. This is again in line with the coopetition literature, which describes that collaboration between competitors usually takes place further upstream the supply chain and that further downstream the value chain, closer to the consumer, there are higher levels of competition. The following facilitator for collaboration, the sharing of financial risks, is an important facilitator in for coopetition amongst system-building firms. This finding is in line with the coopetition literature.

To conclude, in collective system buidling, actors know they have to collaborate with competitors and design collaboration up-front in a way that facilitates collaboration and alleviates its inherent risks. This way, they reduce the dilemma of collaboration versus competition. Conditions which enable collaboration with competitors are: strong coordination by a neutral leader, setting of clear boundaries with regard to knowledge-sharing, carefully selecting network members and sharing of financial risks.

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