Coopetition in low tech industries versus high tech industries

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Coopetition, the concept of cooperation and competition at the same time, is getting more popular in recent scientific literature. An additional concept that this paper tries to connect with coopetition is the distinction between low tech industries and high tech industries. In literature it is not clear whether the coopetition in low tech industries differs from the coopetition in high tech industries. This research will contain a literature review to get a clear understanding of the coopetition in different kind of industries. The paper will first explain the scope of coopetition, after which the advantages and disadvantages of coopetition will be discussed. Three low tech industries and three high tech industries will be researched, based on characteristics of the industry, to see how coopetition is experienced in extreme industries. With these six example industries a comparison can be made between the two extreme industries. With the outcome of this research companies can improve decisions whether coopetitive relationships are needed and what is common in extreme industries.

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1. INTRODUCTION

Nowadays companies have to work more efficient every day. More companies are joining the market and try to get competitive advantages. Instead of competing with competitors, companies can choose to cooperate with competitors, this is called coopetition. Because coopetition is already researched, but not the comparison between industries, the focus of this research is to investigate whether there are differences between extreme (i.e. high tech or low tech) industries and the application of coopetition. Literature shows that there are some differences between high tech firms and low tech firms. A few examples: high tech firms need a more multi-country approach, competitiveness is higher in the high tech sector, high tech companies tend to have more access to an internationally experienced network, high tech companies more often collaborate with larger companies, and high tech companies try to keep their product as long as possible in the introduction phase (Atmer & Thagesson, 2006, pp. 67-69). Do these examples of differences between the two extreme industries lead to a different kind of coopetition within the industry? This research is aimed on that gap. Differences between the industries could lead to the application of different kinds of coopetition. For instance, the high competitiveness in high tech industries could lead to distrust between competitors, resulting in less cooperation. Another example is that high tech companies, because of the more multi-country approach need more collaboration within coopetition with competitors in other countries, because it is more widespread geographically. These firms need to work together with companies that are geographically spread to improve their business through the world. It is important to know how to deal with competitors, it can be the difference between success and failure. It might for example be the case that your company needs certain competences or resources of other companies, or the other way around. There is also a downside on collaboration with competitors, companies do not want to disclose too much information to competitors. Especially for high tech companies information or knowledge of new innovations could be a trigger to collaborate when this information is only with the competitor. Firms can also choose to compete when the advantage of the information is in-house. My proposition is that high tech companies are more willing to be involved in coopetition in the form of cooperation with competitors than low tech companies. The combined knowledge about new innovations the coopetitive companies can get to the company, will lead the company to a higher level in capabilities and resources. Where on the contrary, companies in low tech industries might not need the information or knowledge of other companies. At the end of this paper I will get back on this proposition. With the information that results out of this research, companies in the aforementioned industries could adapt their strategy in matter of coopetitive relationships to be more successful within this industry.

2. LITERATURE BACKGROUND

2.1 Coopetition – Cooperation and competition at the same time

2.1.1 Concept and definition of coopetition

Traditional thinking was to always outsmart competitors, get a competitive advantage over competitors. Driving competition away from the business you are in. This mind-set is not from this time anymore, "you have to listen to customers, work with suppliers, create teams, establish strategic partnerships – even with competitors" (Brandenburger & Nalebuff, 2011). Brandenburger and Nalebuff are the ones who introduced the concept of coopetition in 1996. They combined the concept of coopetition with the game theory, where the business can be seen as 'the game'. In this game there are several players, for example suppliers, customers or competitors. In this game it is not about winning, but a manager needs to play the right game. Managers need to think about the right game to play and what would be the wrong game to play (Brandenburger & Nalebuff, 1995, p. 57).

Coopetition is the reflection of competitive relationships versus cooperative relationships with competitors. Coopetition is the dyadic and paradoxical relationship that emerges when two firms cooperate in some activities, for instance in a strategic alliance, and at the same time compete with each other in other activities (Bengtsson & Kock, 2000). Companies can have vertical relationships like buyer-seller relationships with suppliers but also horizontal relationships: the relationships with competitors. But why should a company be involved in such relationships. Looking at these motives to be involved in cooperative relationships or competitive relationships, firms have to think about what is most valuable for the company and what kind of relationship with competitors fits the best.

At the moment there are three typologies of coopetition, the first typology is from Bengtsson and Kock (2000), they introduced the concept of coopetition in three different relationship styles. Their research is based on whether the relationships of coopetition needs collaboration or competition. The coopetitive relationship can be distributed towards competition, towards cooperation or it could be an equal relationship (Bengtsson & Kock, 2000, p. 416). The second typology is also from Bengtsson and Kock (2003), which is based on the structure of the relationship between competitors. When there are two competitors with the same terms and cooperate and compete at the same time it is called reciprocal coopetition. When there are other actors in play that decide what kind of coopetition is needed (for instance a parent company) it is called multipolar coopetition (Walley, 2007, p. 15). The third typology of coopetition is from a different author. Dowling et al. (1996) distinguishes also coopetitive relationships, where these relationships can be seen as inter-firm relationships. The distinction here is when the buyer-seller relationship of a company could be collaborated with a competitor. This could be direct when a company for instance sells a component, product or service to a direct competitor. This relationships could also be indirect when the company supplies the other company with a component, product or service where the other company is not directly related to that component, product or service. The last kind of coopetition that according to Dowling et al. is present, is 'partners in competition'. Examples of this are a joint ventures, research consortiums and licensing agreements (Walley, 2007, p. 15)[1].

2.1.2 Advantages coopetition

In this section a few advantages of coopetition will be used to further explain why the phenomenon of coopetition is present. An advantage of coopetition with competitors is that coopetition in matter of alliances could strengthen the position of the company, together with the competitor's position with combined knowledge of production, introduction of new products and entry into new markets (Bengtsson & Kock, 2000, p. 414)[2]. In this way the cooperative aspect is that the firms can collectively use their knowledge to produce something that is beneficial to both companies and can therefore better compete with other companies that are not part of the alliance (Khanna, Gulati, & Nohria, 1998, p. 194). An additional advantage of coopetition is

[1] The original article could not be opened (Dowling, Roering, Carlin, & Wisnieski, 1996).

[2] The original article could not be opened (Lei & Slocum, 1992).

that collaboration between competitors can result in the reduction of costs and risks. When investments are being made with multiple companies, the costs and risks of this investment are diminished and more spread. With this, firms can use competitors to handle large projects (Gnyawali & Park, 2009, p. 311). Furthermore, an advantage of coopetition is that it increases the possibilities of technological and capability transfers. With this last point it is important that alliances in joint R&D or product development should be with companies with the same scale and scope in technology-based capabilities. This way the companies can both learn from each other and get the most out of the collaboration (Gnyawali & Park, 2009, p. 318).

2.1.3 Disadvantages coopetition

There are not only advantages for coopetition, therefore this section of disadvantages of coopetition. There is one big disadvantage of coopetition that will lead to several other drawbacks for the company as the result of collaboration with competitors. This is the high risk of opportunism (Bouncken & Kraus, 2013, p. 2061)[3]. This could happen when partners in coopetition can get the feeling they do not get enough return in the partnership and as a result use absorbed or shared knowledge in the future for their own purposes. In the worst case scenario they will share confidential information with other parties, resulting out of general distrust or other objectives and intentions (Walley, 2007, p. 18)[4]. The information that will be disclosed in this matter could dramatically harm the company's business, therefore companies have to think thoroughly about collaboration with certain competitors.

2.2 Concept and differences of low tech and high tech industries

Before making any conclusions on what kind of coopetition is applicable to extreme industries, it needs to be clear what exactly is meant by 'low tech industry' or 'high tech industry'. There is still no clear understanding about what exactly a low tech industry or a high tech industry is, therefore, the classifications of The Organisation for Economic Co-operation and Development (OECD) will be used as a starting point. The OECD is a platform for governments to share experiences and try to find solutions for mutual problems. In working together with different companies the OECD tries to understand what the drivers are behind economic, social and environmental changes. The data of productivity, global flows of trade and investment is analysed to find trends and make predictions about the future (OECD, 2016).

The classification of this OECD will be used as a starting point, later on additional differences between low tech and high tech industries will be discussed and examples will be mentioned of three low tech industries and three high tech industries.

The OECD started in the mid-1980s with a distinction between high tech industries and low tech industries, based on direct Research & Development (R&D) intensity and R&D embodied in intermediate and investment goods. In this distinction low tech firms tend to spend relatively less on R&D, compared high tech firms. The OECD came with the classification of low tech industries, medium low industries, medium high industries and high tech industries, that can be seen in an overview in table 1 below.

Table 1 – OECD's classification: R&D/turnover per industry (Hirsch-Kreinsen, Jacobson, & Robertson, 2006, p. 6)

	R&D/turnover
Low tech industries	<0,9%
Medium low tech industries	0,9-3%
Medium high tech industries	3-5%
High tech industries	>5%

A few examples of high tech industries with the classification of the OECD: Aircraft and spacecraft, pharmaceuticals, office, accounting, computing machinery, radio, TV, communications equipment and medics. For low tech industries there are also some examples: manufactory, wood, food and textiles (Rev). Because the OECD only looks at one characteristic of the industries, it is better to give some additional differences between low tech industries and high tech industries (also shortly mentioned in the introduction).

The differences between the two extreme industries will be mentioned below. High tech industries do have a more multi-country approach, which means that overall high tech firms are more globally focused than low tech firms. This is due to the fact that in the high tech sector, firms have a smaller number of customers per country, when this is combined with the influence of larger companies with whom the companies collaborate, there will be a more multi-country approach. The second difference between the two extreme industries is that in high tech industries there is relatively more competitiveness present than in low tech industries. The competitive aspect of high tech firms is mainly because of the demand of differentiated, new developed products. A third difference is that high tech firms seems to have more access to the global network. An internationally experienced network results from the interests of multinationals in high-tech products and therefore collaborate with these high tech firms. A fourth additional difference is that high tech firms collaborate more with larger companies than low tech companies. Research and development is the origin of this difference, larger companies often collaborate with smaller high tech firms to increase their product range. The last difference that will be mentioned here is that there is a difference in the product life cycle between the two extreme industries. Logically, more products are introduced where the demand rises. High tech firms try to use research and development in existing products to keep products in the introduction phase. This way the high tech firms want to trigger demand in existing products. This is not the case for low tech firms, these firms just let the products go through the whole product life cycle in a natural way (Atmer & Thagesson, 2006, pp. 67-69). An overview of these differences can be seen in table 2 on the next page.

[3] The original article could not be opened (Levy, Loebbecke, & Powell, 2003).

[4] The original article could not be opened (Park & Russo, 1996).

Table 2 - differences between two extreme industries[5]

	Low tech industry	High tech industry
Relatively more R&D intensity[6]		X
Relatively a more multi-country approach		X
Relatively more competitiveness		X
Relatively more access to the global network		X
Relatively more collaboration with larger companies		X
Keeping products relatively longer in the introduction phase		X

The differences between the two extreme industries can also be made looking at the kind of products that are made in that certain industry. High tech markets can often be seen as complex and difficult to predict. Innovations will be technology driven, where lifecycles are short and rapid decisions occur often. (Rosen, Schroeder, & Purinton, 1998). The technology driven products are mostly product-focused and could therefore miss the aspect of customer-focus. In low tech industries this is less plausible because there will always be a steady demand for low tech products like food or steel (examples in this paper).

3. METHODOLOGY

The investigation whether low tech firms differ from high tech firms in terms of coopetition start with a clarification on what exactly is meant by coopetition, low tech industries and high tech industries. This is already explained in the literature background before.

After the literature background of the concepts of coopetition and high- and low tech industries, this paper will go more in practise of the subject of coopetition in certain industries. There will be three examples of the coopetition for low tech industries and three examples for coopetition in high tech industries. In the following sections first there will be a short explanation why the industry is high tech or low tech, then a small introduction of the market, after which it will be clear what kind of coopetition is present in that certain extreme industry. The low tech and high tech industries are chosen based on several characteristics of the industry, that will be mentioned at the beginning of the separate sections. For low tech industries literature of Kotzab and Teller (2003) will be investigated for the grocery industry, for the agri-food industry will be looked at the research of Walley and Custance (2010) and for the steel industry there will be an overview of literature of Sroka (2013). To get an image of the coopetition in high tech firms, literature in the European biotechnology industry from Garcia and Velasco (2002) will be investigated, next to the pharmaceutical industry by Ruizalba et al. (2016) and the global ICT industry from Ritala et al. (2008).

Subsequently, comparisons can be made to see whether there is a difference between high tech firms versus low tech firms in terms of coopetition. After which the limitations of this research will be described and finally the conclusion of the whole paper.

4. COOPETITION IN LOW TECH INDUSTRIES

In this chapter there will be three examples of low tech industries and the kind of coopetition in it. Each low tech industry will start with arguments why it is a low tech industry followed by the differences of that low tech industry compared to high tech industries. Then, there will be a short introduction of the market, after which an explanation will be given of the coopetition in the industry in terms of collaboration and competition. Additionally, reasons will be discussed why a certain kind of coopetition is present in the industry and finally expectations will be mentioned for other low tech industries.

4.1 Grocery industry – coopetition

The first industry that will be researched is the grocery industry and in this case in Austria. The grocery industry is a low tech industry because of a few reasons. Firstly, the grocery industry is part of the food and drink industry. According to information of the 'Data and trends of the European food and drink industry', the R&D intensity (as a percentage of turnover) was 0,53% in 2009 (Europe, 2012, p. 20). This is relatively low, when for instance compared to the high tech industry of the biotechnology, where it is 25%. The R&D intensity of 0,53% is in the first quadrant of table 1 for low tech and high tech firms in terms of R&D intensities. Food is mainly a low tech product that is not technology-driven, it does not need the newest innovations to be a success. When the industry will be compared to table 2, some points of attention arise. There is a strong case of competitiveness active in the industry but with a remark. The competiveness is mostly on price, food does not differ that much between firms. Compared to high tech firms, where firms try to differentiate products on technology continuously, the competiveness is relatively less because it is only on price. Also, the food industry does not need collaboration with larger companies to gain certain knowledge, this in contradiction to high tech industries as for

[5] This table is based on the relativity between the two industries, the comparisons are only between each other.

[6] R&D expenditure divided by turnover

instance the biotechnology. Neither does it need a global network to keep the steady demand for food going.

The example of the grocery industry as a low tech industry is from a case study from Austria, where data was gathered by several surveys among companies and managers (Kotzab & Teller, 2003, p. 12). The market of the Austrian grocery industry can be characterised as highly concentrated where two large retailers account for around 70% market share. This is a result from a decreasing number of retail outlets (from 2000 in 1960s to 6656 in 2001). The concentrated market share is also a result from increasing size of retail outlets, where larger companies 'crush' the smaller companies with highly competitive price wars. Another movement in this industry is that customers relatively spend less on grocery than before.

Now that the market is introduced, the two contradicting aspects of coopetition can be discussed: collaboration and competition. A model of collaboration in this market is the Efficient Consumer Response (ECR). With this model several players in the supply chain of the grocery industry try to avoid duplications of costs and to improve the service, between producer, retailer and end user. All as a result of harmonisation and cooperative adaptation of commonly agreed business processes. This vertical collaboration between supply chain partners is based on efficient store assortment, efficient promotion, efficient new product introduction and efficient replenishment. The transformation from departmental completion to organisational cooperate solutions extinguishes financial and procedural waste from the channel. This way the competition in the grocery industry changes from company vs company to supply chain vs supply chain. The collaboration between capable players could then be on collaborative planning, forecasting and replenishment, where competition is based on the building of such a supply chain.

In general, there is competition active on two levels. The manufactures' level, where competition is brand against brand and at the retailers' level, where competition is discounter against supermarket or grocery store against drug store. The reason to start a collaboration with a competitor is because the previous competition leads to a decline of brand, product and retail format loyalty. Especially from this last point of view, collaboration could be applicable, but still with competitive elements. This means that the collaboration in the Austrian grocery industry is applicable in logistics, on the background. Competition on the other hand is more on the foreground, in marketing, to see for customers. In this low tech industry there is still not a lot of coopetition but the conclusion is that it is possible on the background only. The collaboration is merely with players in the supply chain, instead of with direct competitors.

I expect this kind of coopetition also in other low tech industries, because especially in low tech industries the supply chain is more plausible to work as one system. This has to do with trust and costs. In low tech industries the knowledge is less technology intensive. Therefore people are more eager to trust each other without the fear of opportunism. This collaboration can be achieved in their own supply chain, without the need of information from outside the chain (competitors). The other reason to work together within the own supply chain is to cut down costs. In low tech industries the focus is more on cost efficiency and this can also be achieved in the own supply chain.

4.2 Agri-food industry – coopetition

The next example of a low tech industry is the agri-food industry. The agri-food industry belongs, just like the grocery industry in the food and drink industry. Therefore, the R&D intensity can be compared with the same score as the grocery's industry, namely 0,53% per turnover. Also, just like the grocery industry, food is a low tech industry that does not need a technology driven industry. Furthermore the agri-food industry with its agricultural products is one of the oldest industries on the world, where already a lot is changed through the century but the main business of low tech agricultural products will keep the same. Like it has been said in section 4.1, in the food industry there is relatively less competitiveness, less collaboration with larger companies, less collaboration with the global network. In the case of the food industry life cycle phases of the product will go naturally, no measures of technology will be used to keep the product in the introduction phase.

The article of Walley and Custance will be used to examine the coopetition in this industry (Walley & Custance, 2010). Six case studies are used to investigate the coopetition in the agri-food industry. From these six case studies there are a few findings that are interesting to mention in terms of coopetition. It becomes clear that companies in this industry involve in a coopetitive relationship not only for knowledge sharing, learning and pooling competences but also for other benefits, other than their business. Reasons here could be political factors where normally economic factors are visible. The next finding is that people in the agri-food supply chain are not always aware that they are involved in such a coopetitive relationship. For this reason the activities that managers are involved with are not always in the best interests of the other actors (with whom the coopetitive relationship is with). Furthermore, it is difficult for some people to be involved in two contradicting activities, namely competition and cooperation. It depends on the person who needs to communicate with the partner, from this industry it seems that not every person can be a good intermediary for a coopetitive relationship. Moreover, literature explains that coopetitive relationships often cooperate in upstream activities and compete in downstream activities (Walley, 2007, p. 17). The case studies show some contradicting results in this matter. One case shows that the cooperation between farmers is (contradicting to the literature) in downstream activities like marketing the product and competition is in upstream activities associated with production of fruit. Another case shows that cooperation is in upstream activities like the development of new products and that competition is in downstream activities as marketing the product and obtaining a return on the investment (as explained by literature). Additionally, the farmers in the agri-food industry preferably cooperate in the background and compete on the foreground. The farmers compete in selling their own products but 'secretly' cooperate in abiding the rules of the FARMA (The National Farmers' Retail & Markets Association). Another important point in the coopetition style is that it depends on a certain leader, leadership is important in organising and instigating coopetition. This leader acts as a middleman to not only organise the coopetitve relationship but also to decide upon the whole approach to the coopetitive relationship. Additionally, the case studies show that companies only involve in cooperation when competitive activities are not enough. So, when only competition is not enough to be a success in doing business, a company will look at the opportunity of establishing a coopetitive relationship. This development is also supported by the literature (Peng & Bourne, 2009). The last finding of these case studies is that supply chain arrangement do not always need a coopetitive element, it could be for example the case that a farmer only cooperates on a transactional basis, where no coopetitive relationship is needed.

Concluding, in the agri-food industry there are coopetitive activities but it depends on the situation or company. For example, it differs per person, especially when that person is the leader. Even sometimes no coopetitive relationship is needed. Some farmers cooperate in downstream activities as marketing their product and compete in upstream activities as the

production of fruit. While other farmers cooperate in upstream activities as the development of new products and compete in downstream activities of marketing the product.

This industry showed that even in industries there are lot of differences in coopetition. Even though the case showed that upstream activities as the development of products can also be collaborated with competitors in low tech industries I expect this will mostly the case in high tech industries instead of low tech industries. This is mainly because of the knowledge that is needed for the development of new products, for low tech industries the information of the development of new products of competitors is less needed than in high tech industries and therefore I do not expect such movement in other low tech industries. Additionally, this industry also showed that it differs per person, what I think should not be an obstacle to coopetition. I expect that other low tech industries have less coopetition, because the industry does not need it, not because a person is not capable to have such a relationship with a competitor.

4.3 Steel industry – coopetition

The third low tech industry that will be looked at is the steel industry. The steel industry belongs to the low tech sector, firstly because the R&D expenditure per turnover is in the first quadrant of 0-0.9%. For comparison, literature of the steel industry in India of major steel firms were investigated. The R&D expenditure per turnover of several major steel companies was in 2010 below 0.9%, namely 0,24% and 0,21% (Singh, 2011, pp. 34, 36). Another characteristic earlier mentioned is that low tech industries tend to have less access to the global network. This is also the case in the steel industry (in Poland). In this industry the globalisation is not as present as in other (high tech) industries where globalisation is more dominating (Sroka, 2013, p. 128). Low tech products like steel do not need the global network in order to perform well. The resources and the merger of network (as will be mentioned below) is enough, it does not need high tech knowledge or the newest innovations of larger companies across the world. Just like the grocery industry and the agri-food industry, the steel industry is because of its basic product of steel mainly competitive on price and therefore compared to the high tech industries less competitive

Coopetition is still a new development for the Polish steel industry, the first coopetitive relationships between competitors started only in the first years of twenty-first century. This was a result of the following steps of the steel industry in Poland: privatisation and restructuring, outsourcing and core business improvement, partnership cooperation, cooperation in value chain and at last the merger of networks. Now that the steel industry in Poland is in the last step of merger of networks, there are several movements visible within the industry. There are networks where there are only a few participants, to reduce the risk of competition. On the contrary, there are also networks where more participants are included. Here, competition can only be overseen when participants cooperate with each other within the network. The internal competition in the network of this last case results in more flexibility, innovation and ensures security of supply. Within this network there are five factors: the steel enterprise, clients, suppliers competitors and complementary organisations. Cooperation in this network can occur vertically when suppliers and clients build relationships together to create value. All the participants in the network profit when the suppliers create more value and therefore such activities should be cooperated. Complementary organisations in this case are a little bit tricky because the cooperation with these companies can add a competitive advantage over competitors, so increasing cooperation could also lead to increasing competition.

In the Polish steel industry, a classic example of collaboration on a horizontal level is service levels. This way complementary organisations can create more attractiveness of partners for suppliers instead of the collaboration with competitors that reduce the attractiveness of suppliers to the consumers. This view is still among firms in the industry, there seems to be a lack of trust though, that results in competitive behaviour instead of collaboration. Because of this lack of collaboration, according to Sroka (2013), the coopetition in the steel industry is still on a low level. Most of the networks were dominated networks: coopetition between steel companies and sector related companies. So the collaboration is most of the time with complementary firms instead of with competitors. The competition with competitors in this industry is still strongly active. A survey among 125 companies in five steel-related sectors showed that inter-organisational cooperation strategies are still not popular and according to Sroka this is because of the lack of globalisation of the industry. He thinks that coopetition in low tech firms like the steel industry is still not strongly developed, because the industry does not have a strong level of globalisation. High tech industries with a high level of globalisation should have more coopetition (Sroka, 2013, p. 130).

The steel industry showed that the collaboration in the industry is mostly with complementary organisations instead of competitors. I expect his would be the same in other low tech industries. Organisations do not need the cooperation (also mentioned in section 4.1) and with the cooperation the capabilities and resources of competitors. Collaboration with complementary organisations will only add value without the fear opportunism.

5. COOPETITION IN HIGH TECH INDUSTRIES

In this chapter there will be three examples of high tech industries and the kind of coopetition in it. Each high tech industry will start with arguments why it is a high tech industry followed by the differences of that high tech industry compared to low tech industries. Then, there will be a short introduction of the market, after which an explanation will be given of the coopetition in the industry in terms of collaboration and competition. Additionally, reasons will be discussed why a certain kind of coopetition is present in the industry and finally expectations will be mentioned for other high tech industries.

5.1 Biotechnology industry – coopetition style

The first high tech industry that will be researched is the European biotechnology industry. The biotechnology industry can be seen as a high tech industry, this is for several reasons. Firstly, the R&D expenditure as a percentage of revenue in the whole industry was on average 25% in 2014 (Acharya et al., 2016). This relatively high percentage of R&D points in the direction of a high tech industry, because it is clearly in the highest quadrant of table 1. Secondly, according to Garcia and Velasco (2002) companies in the biotechnology must develop collaboration networks to deal with critical information, and overcome uncertainty, appropriability and intellectual resource immobility. This, combining with inter-firm relationships to improve the technological innovations and high speed-learning (Garcia & Velasco, 2002, p. 4), are all characteristics of high tech industries, showed in table 2. Also, the small to medium dedicated biotechnology firms that will be explained below are all cooperating with larger firms. This way financial capital will not be a problem and the small and medium sized firms can keep working flexible and innovative. A last difference between a high

tech firm like the biotechnology and low tech firms is that in the biotechnology industry the product-development process is long and intensive, this means that the introduction phase will be stretched.

The coopetition in this industry will be investigated with the literature of an empirical study of the correlation between strategic behaviour and performance (Garcia & Velasco, 2002). The biotechnology has the characteristics of a long product-development process, where research is most intensive. In the empirical study there will be calculations of correlations with on the one hand cooperation and up- and downstream alliances and on the other hand development of product lines and technological diversity.

In the article there is support for the hypothesis that cooperation with competitors has a positive effect on the development of new product lines. It seems that collaboration with close competitors is not only a useful tool to acquire innovative technical knowledge and skills from the competitor, but also to create and access other capabilities. Because this study was mostly conducted under small and medium sized dedicated biotechnology companies, the collaboration with larger diversified biotechnology companies also has a positive effect on new product lines. This is because the larger companies can more easily access or provide experience and capabilities to testing procedures, regulatory processes and commercialisation. Another collaboration in the biotechnology industry is the collaboration with universities and research institutes. This can be an advantage, because universities have the information about new innovations with high potential, that these small and medium biotechnology firms can get to market.

When the correlation between cooperation with direct competitors and the technological diversity is investigated it becomes clear that this is also positively correlated. The reasoning behind this is that small and medium sized biotechnology companies often are very specialised in certain innovations or technologies and can therefore be very important and useful for larger companies to cooperate with. The small and medium sized companies can keep their flexibility and innovativeness because of their small size, when keeping in mind the strong financial background of the larger company. On the contrary, these small and medium sized biotechnology companies should not cooperate with larger companies that are not diversified in biotechnology, this would have a negative effect on the technological diversity.

Coopetitive relationships are created from the advantages and disadvantages, upstream and downstream. Upstream cooperative relationships in this industry are relationships between university, research institutes and the biotechnology firms. The universities and research institutes provide access to information about new innovations. Biotechnology firms want to cooperate with these firms before competitors do. When the university or research institute already cooperates with a competitor, it can be seen as a competitor. In downstream activities the collaboration is merely between larger companies and the small and medium sized biotechnology firms. The firms are a source of information and direct access to leading edge science. In this case there are coopetitive relationships where the larger firms and smaller firms work together to get to new innovations and on the other hand compete on the market. There are also relationships of only collaboration where the smaller and larger firms do not compete with the same technology in other activities.

Concluding, it seems that for a high tech industry like the European biotechnology industry cooperation with direct competitors would be significantly useful, because of a positively related development of product lines and a positively related effect on technological diversity. Coopetition in this high tech industry is already on a higher pitch than the three previous mentioned low tech industries. This is mainly because the combined knowledge of new innovations and technologies of competitors is most important and significantly useful in a technology driven industry.

The biotechnology industry showed that coopetition does have a few great advantages for high tech industries, as main advantages a positive effect on product lines and technological diversity. Because these are two important pillars for the high tech market I expect that coopetition in other high tech industries will be similar, by all means, needed. This is a difference with low tech industries where for example technological diversity does not seem as vital as in high tech industries.

5.2 Pharmaceutical industry – coopetition

The second high tech industry that will be mentioned and investigated in this paper is the pharmaceutical industry. In 2002 in the United States, pharmaceutical companies were researched in terms of R&D expenditures, it showed that the thirteen biggest U.S. pharmaceutical companies spend 14 percent of their turnover in R&D (Reinhardt, Hussey, & Anderson, 2004, p. 18). Moreover, OECD came with data of 12 OECD countries and their mean R&D intensity between 1991-1999 for pharmaceuticals was 10,5% (Rev, p. 6). Both the percentages point clearly to the highest quadrant of table 1 and the pharmaceutical industry is therefore a high tech sector with a R&D intensity of >5%. Subsequently, the industry of pharmacy is important for the health care sector and therefore for humans all over the world. In this matter, pharmaceuticals do always have a multi-country approach and the global network of new health care innovations are of vital importance. Another difference between the high tech pharmaceutical industry and the three low tech firms is the introduction phase of new products. The introduction of new medication takes logically more time than the introduction of food or steel.

Pharmaceuticals in Spain and Portugal will act as an example in this paper as a high tech industry and the coopetition in this industry (Ruizalba, Soares, & Morales, 2016). Ruizalba et al. (2016) investigated the pharmaceuticals in the aforementioned countries and found out that it is an ongoing growing industry and that it is expected to continuously grow until 2017. Especially because of the essential role and social impact of medical help and health care, R&D investments are in constant need for medical developments. In Spain the top 8 companies had in 2013 already a market share of almost 90% so it seems already quiet concentrated, where in Portugal the seven biggest companies account for even more than 90% of the market share.

When the actual coopetition in the industry is overlooked the impression is that the coopetition in the Portuguese market is somewhat stronger present than in the Spanish market. Reasons for this is that the Spanish market is more mature and a little bit further in the offering of services in the pharmaceutical environment and are therefore not in need of partnerships with competitors. Portuguese pharmaceuticals cannot offer all the service that Spanish pharmaceuticals can. This results in more pressure on the Portuguese market that causes more collaboration, because services of others are needed. At the same time there is more competition in the Portuguese market, because there are less services available. Another finding in this high tech industry is that when a market gets older like the Spanish pharmaceutical market, it is getting more divided, what in this matter results in more competition. Opportunities of further development are still present, because of the lack of collaboration.

The pharmaceutical industry in Spain and Portugal did only show a little bit of coopetition in services. I expect that this will be different in other high tech industries. Especially with the development of new high tech products, firms should bundle resources to add overall value. Furthermore, the coopetition in this industry was too vague to make overall expectations for other high tech industries.

5.3 ICT industry – coopetition

The third high tech industry that will be investigated is the global Information and Communication Technology (ICT) sector. The ICT industry is just like the biotechnology industry and the pharmaceutical industry a high tech industry because of the following points. To see how much money is spend on R&D per turnover in the ICT industry, the corporate R&D intensity of the five leaders in ICT in the United States (IBM, Cicso, Microsoft, Google and Intel) and the five ICT leaders of the rest of the world (Canon, Ericsson, Huawei, Nokia and Alcatal Lucent) are looked at (Wadsworth, 2014, p. 25). It becomes apparent that the R&D intensity of these 10 ICT leaders is between 5% and 19%. This is in the highest quadrant of low/high tech industries in terms of R&D intensities (>5%). The ICT industry is technology driven and therefore every innovation or new technology is obsolete within a few years. Also, because the ICT is globally available and thus with ICT one has more access to the global network. Big companies like those mentioned before are all multinationals with a (logically) multi country-approach. Small ICT firms that are successful are often bought by companies as Microsoft or Google or only work together with these Multinationals. These are all characteristics of high tech industries and clearly differ from the three low tech industries, where the focus more on price and product, without the vital need of multi-country networks.

Coopetitive relationships will be measured according data from global companies in competitive and cooperative networks (Ritala, Hallikas, & Sissonen, 2008). The network analysis that this research provides is used to see what kind of dyadic relationships occur between different participants of the ICT industry.

The network analysis shows that companies with high cooperative centralities seem more likely to be active in coopetition relationships than companies with high competitive centralities. This might be logical because these firms are already affirmative in sharing resources and other capabilities. Additionally, the study shows that telecom operators differed in outcome from other companies, in terms of coopetitive relationships. These firms did not show any coopetitive relationships, because these niched companies were too much focused on competition rather than cooperation with companies from different business segments. In misalignment with this is that big global players (who are focused on more than one business segment) like Microsoft are more likely to cooperate with competitors, because it is easy for Microsoft to combine complementary resources and capabilities without fear of competition. Therefore, it seems that it is easier for larger companies that are active in multiple business segments in ICT tend to be more active in both high cooperative activities and high competitive activities. This is also in alignment with literature, where is stated that global rivals can more easily be involved in coopetitive relationships, because they are involved in a lot of businesses and can therefore compete in some businesses and cooperate in others (Luo, 2004, p. 11).

Concluding, in the ICT industry there are some differences in coopetition styles between different kind of companies. Telecom operators are too much focused on competition and can therefore not be involved in coopetitive relationships, where large companies with different business segments in ICT are more successful with coopetitive relationships with competitors. Thus, it seems that when companies get bigger in this sector (like Microsoft) they can more easily get involved in coopetitive relationships.

The ICT industry showed that there are some differences in coopetition within an industry. Telecom operators are not involved in coopetition and I expect this will be an exception for high tech industries. The large ICT multinationals are involved in coopetition, because these companies do not compete in every business segment and thus use the collaboration where needed.

6. COMPARISON COOPETITION – LOW TECH INDUSTRIES VERSUS HIGH TECH INDUSTRIES

In this section the comparison will be made between the two extreme industries, low tech and high tech. In order to make this comparison a short recap of the industries will be given.

The three low tech industries are the grocery industry, the agri-food industry and the steel industry. In the grocery industry there is still not a lot of coopetition in the form of collaboration, this is mostly only within the own supply chain of the company. This vertical collaboration between supply chain partners is based on efficient store assortment, efficient promotion, efficient new product introduction and efficient replenishment. All in all, significant reduction of costs. The competition in this market is on two levels. A manufacturers' level in the form of brand versus brand and on a retailers' level, where competition is grocery store versus drug store. In this industry the collaboration is merely in logistics, instead of in marketing. In the agri-food industry there seems already a bit more cooperation with competitors than in the grocery industry. According to Walley and Custance (2007) there are cooperative relationships through the whole supply chain. The case studies from this industry show some contradicting results in this matter. One case shows that the cooperation between farmers is (contradicting to the literature) in downstream activities as marketing their product and competition is in upstream activities associated with production of fruit. Another case shows that cooperation is in upstream activities like the development of new products and that competition is in downstream activities as marketing the product and obtaining a return on the investment (as explained by literature). This is different from the grocery industry where collaboration was merely in upstream activities and within the own supply chain. The third low tech industry mentioned in the paper was the steel industry. Just like in the other two low tech industries, coopetition seems somewhat absent in the steel industry. According to Sroka (2013) companies in low tech industries like the steel industry, where there is not a strong level of globalisation, coopetition is not necessary nor needed. He thinks that competitors do not cooperate that much with each other, because they do not need the support or collaboration from competitors. When firms get larger and are operating in more countries there is a stronger need in cooperation with competitors. Like it has been said in the literature background, this is also predicted by the literature, because low tech firms are relatively less focused on a multi-country approach, compared to high tech firms. The collaboration that is present in this sector is mainly based on service levels, where firms still prefer to collaborate with complementary companies, instead of direct competitors. To conclude on coopetition in the three low tech firms, firms are reserved towards competitors. Cooperation is mainly upstream in the grocery industry, where it is upstream and downstream in the agri-food industry. The collaboration in low tech industries is mostly within the supply chain and with complementary organisations. It seems that cooperation with competitors is still somewhat lacking because of trust and

simply, because firms in low tech industries do not always necessarily need the collaboration with competitors, where high tech firms might be more in need of knowledge of competitors and therefore cooperate.

The three high tech industries mentioned in this paper are the biotechnology industry, the pharmaceutical industry and the ICT industry. In researching the biotechnology industry it becomes apparent that the coopetition is different compared to the low tech industries in at least this high tech industry. Firms work more closely together with competitors in this industry, because it has several advantages. In the biotechnology industry, firms cooperate with direct competitors because it has a positive effect on the development of new product lines. This positive correlation is because companies can this way acquire knowledge about the newest innovations in the industry. Another advantage of cooperation with competitors is that the technological diversity positively would be influenced. Small and medium sized biotechnological companies work together with larger companies, this way the smaller companies can keep their flexibility, innovativeness and therefore their diversity. The second high tech industry addressed in this paper is the pharmaceutical industry. Coopetition in this industry is mainly based on offering services. In the Spanish market it seems that when the industry gets more mature, less cooperation is needed. In the Portuguese market the competition is somewhat stronger, because there are less services offered, but collaboration is also needed because the quality of the services are still not on the level of the Spanish market. In this industry it seems that maturity of an industry leads to less cooperation. The third high tech industry mentioned in this paper is the ICT industry. In the example of the ICT industry there are two different streams of companies with different kind of coopetitive relationships. On the one hand there are the telecom operators who do not show any cooperation, only competition, because according to Ritala et al. (2008), the telecom operators simply do not need any kind of cooperation. Though, in the ICT sector there are also large ICT multinationals like Microsoft. These multinationals cooperate with competitors or other smaller/medium sized companies to combine resources. In this high tech industry it seems that when firms get bigger, get more involved in global activities, coopetitive relationships are more needed.

Now that the three low tech industries and the three high tech industries are discussed, a comparison can be made. In the three low tech industries the coopetition is still on a low level. The lack of the necessity in cooperation with competitors in these industries seems vital enough to choose to go on with competition instead of starting a coopetitive relationship. In these low tech industries the cooperation is mainly within the supply chain, with complementary organisations, in upstream activities and in activities in the background like logistics. On the contrary, in the high tech industries there seems to be a necessity to cooperate close with competitors to acquire the certain knowledge that is needed for doing business in the high tech sector. Other advantages are new product lines and technological diversity. Still, for some typical companies in high tech sector competition is still the main focus, for instance for the telecom operators in the ICT industry. An additional difference between the two extreme industries has to do with globalisation. Larger companies that are involved in globalisation use more cooperation with competitors than companies that are not involved in globalisation. The companies in the three high tech industries are compared to the companies in the three low tech industries more multi-country focused and therefore need more cooperation. Other factors that influence the coopetition in an industry are the maturity of the company, maturity of the industry, size of the company and people involved in the coopetitive relationship.

The expectations for other industries with this research are that the six industries more or less can be held accountable for other low tech industries and high tech industries. I expect that other low tech industries also mainly cooperate in its own supply chain like in the grocery industry and that the cooperation with other companies will be mainly with complementary organisations like in the steel industry, both reasons are to add overall value. In the agri-food industry there is some contradicting behaviour where sometimes cooperation is merely upstream and sometimes downstream. I prospect the cooperation in low tech industries will be mostly upstream activities instead of downstream activities because this could lead to the most added value. I expect that coopetition in other low tech industries is also undeveloped because of the lack of necessity to cooperate with competitors. The three high tech industries showed that coopetition is not always the same, but that high tech industries demand somewhat more cooperation than low tech industries. Expectations here are that the cooperation in for instance the development of new products are important for high tech industries. This for instance for technological diversity and new product lines like in the biotechnology industry. Other high tech industries demand a lot of technology and knowledge and this cooperation between competitors could boost this phenomenon. I think that telecom operators (ICT industry) with no coopetition at all are exceptions in the high tech sector, where competitors need each other.

7. DISCUSSION AND MANAGERIAL IMPLICATIONS

This paper is merely based on existing literature, thus it might be the case that outcomes will change when other literature will be published.

With this research managers can gain knowledge about coopetition and the technology level in the industry. Companies can see whether they are active in a high tech industry or a low tech industry. With this information managers can get an image of the industry they do business in, how companies act on average in that certain industry. Firms can adapt the strategy when coopetition is different than thought before. When companies for instance cooperate a lot with competitors, but the industry is low tech, it might be better to change the strategy of building relationships with competitors. It could also be the case that a certain industry develops from low tech to high tech, this might also have consequences for the coopetitive relationship that an industry is demanding from a company.

Moreover, existing literature (Walley, 2007) explains that cooperation between competitors is mainly in upstream activities. The agri-food industry shows that this is not the case, in this industry it depends on the company or the person who is involved in the coopetitive relationship, some of them cooperate in upstream activities and some of them cooperate in downstream activities, competition vice versa.

8. LIMITATIONS AND FUTURE RECOMMENDATIONS

The concept of high- and low tech industries differs throughout the literature. In this case I used the concept of OECD, explained by Smith (2000). This concept only uses one variable (R&D) to measure the intensity of technology in an industry. To make the distinction between the two extreme industries more clear there are some comparisons to show differences relatively to each other. These comparisons are only between the two extreme industries so it does not give a clear image of how much for

example the industry multi-country focused is. This is all due a lack of clear characteristics of a high tech industries or a low tech industries in literature.

In this research there are six industries that act as examples of extreme industries, three high tech industries and three low tech industries. Although these industries lean to being high tech or low tech, they are not perfectly high or low tech. Especially when the explanation of a high tech industry or a low tech industry would be more complete. Also even within industries there are some differences in technology, for example in the ICT industry the telecom providers might differ in technology from large ICT companies like Microsoft.

In this research only six industries are investigated. It might be the case that other low tech industries dramatically differ from the three low tech industries used in this research. It is not significantly enough to make reliable conclusions for all the low tech industries, the same goes for high tech industries. In future research one should look at more industries so that a certain trend is easier to see, whether there is a trend at all.

To get an overview of the coopetition in an high tech industry or low tech industry, there needs to be an industry in literature that acts as an illustration of a high or low tech industry. For instance for low tech industry I looked at the grocery industry, agri-food industry and the steel industry. Even though these three industries are low tech industries, it might be the case that the coopetition differs in other low tech industries. This is also the case with the countries. The Polish steel industry is researched in this paper, but it might be the case that the Polish steel industry differs with for example the Dutch steel industry. The reason to choose these industries is based on the available literature, the literature lacks in information on the subject of coopetition in certain industries.

9. CONCLUSION

Coopetition is still an important pillar for businesses. It can make or break the success of company in the form of bundling resources or opportunism. In the beginning of this paper I came with the following proposition: High tech companies are more willing to be involved in coopetition in the form of cooperation with competitors than low tech companies. The combined knowledge about new innovations as a result of coopetitive relationships between companies can get the company to a higher level in capabilities and resources. Low tech industries might not need the information or knowledge of other companies. There is indeed a tendency that high tech firms are more involved in coopetitive relationships, these high tech firms are more willing to cooperate with competitors to for instance develop new product lines or enhance technological diversity, like in the biotechnology industry. Coopetition in the low tech industries is still on a low level, this seems to have to do with the (lack of) necessity of cooperation with competitors. Firms do not see the usefulness of working together. The cooperation in low tech industries is mainly in upstream activities, within the supply chain, with complementary organisations and in the background, away from the customer. Although there are differences between the high tech industries and low tech industries in terms of coopetitive relationships, there are also other factors that influence these relationships. These factors are: globalisation, maturity of the industry, maturity of the company, size of the company and the people involved in the coopetitive relationship.

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