

# Building Networks for Delivering Integrated Product-Service Offerings (IPSOs)

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## Abstract

The paper describes the effect of forming business networks and collaborations for the purpose of developing an Integrated Product-Service Offering (IPSO) using the Product/Service Systems (PSS). The research method is an in-depth case study of a joint venture formed by four companies developing a new technology for chemical extraction from water sludge waste within the pulp and paper industry. Combining literature from PSS, network theories and collaborative product development, this paper puts forward the benefits for SMEs to collaborate in business networks and produce IPSOs when introducing a new technology in an emerging market. The case study shows that working towards the new market would not have been possible if each party acted individually or maintained their traditional buyer-supplier-operator roles, and that IPSOs can reduce the business risk.

## Keywords

Product/Service Systems (PSS), Business-driven Networks, Collaborative Product Development (CPD)

## 1 INTRODUCTION

There is a great potential for Sweden and Swedish companies in the area of environmental technologies<sup>4</sup>. Especially, there is a large need for clean-tech solutions in developing countries where numerous ongoing infrastructure projects in industry and public sectors require technical solutions in order to encourage a sustainable society. The challenge is that full-scale demonstration plants are required to show proof-of-concept, preferably on-site in the developing country. Developing such total solutions that encompasses a whole production system – from suppliers, to producers, to customers and users – requires both financial strength and capabilities to manage business relations of many parties. Since many of the Swedish clean-tech companies are small, this is usually overwhelming challenges, and therefore export of Swedish environmental technology to developing countries where the need is vast is still quite weak [1], [2]. Nonetheless, previous research has shown that business networks can be an efficient way for SMEs to deliver complete offerings [3]. Moreover, technology-based SMEs need support for growth [4], [5].

## 2 OBJECTIVE

The objective of this paper is to analyse the creation and development of business-driven networks for the purpose of developing an integrated product-service offering (IPSO), in response to a need and opportunity spotted in an emerging market.

## 3 METHODOLOGY

In this study, the business network was chosen as the unit of analysis [6]. This finds support in, e.g. Mont [8], claiming for PSS that “(t)he challenge with the new

*approach lies in developing system solutions, where bits and pieces fit together, integrated into a system of people satisfaction” [7].*

The case study was conducted as part of the LIAN<sup>5</sup> research project (2008-2010) focusing on the development of the innovation process in small environmental technology companies. The main goal of the project is to realise a systems solution through collaboration with other parties in business-driven networks. The research is performed as a joint-effort between KTH, LIU and a risk capitalist with interests in emerging markets.

A total of eight interviews were performed with respondents from five different companies and organisations. Due to the study being anonymous, the identities of the companies and respondents cannot be revealed. The roles of the companies, however, are detailed in the case description.

The case study is based on

- 1 a retrospective study where the innovation processes in terms of the technology development process and the business development process are the main foci, and
- 2 an ongoing study of the same case where the launching and testing of the full-scale pilot plant and implementation of their business model is being followed. Since both technical problems are currently being dealt with on site at the emerging market, and business issues are likewise currently undergoing negotiations, the respondents and the companies need to stay anonymous in this case description.

A semi-open interview guide was prepared based on topics central to the research project, i.e. on collaborative product development, PSS offerings, and business-driven networks. Questions were open-ended to allow

<sup>4</sup> Definition of Environmental Technology (or CleanTech used synonymously) according to EU Environmental Technology Action Plan (ETAP).

<sup>5</sup> LIAN in English translates as “Management of Innovation Processes for Business-driven Networks”.

interviewees the opportunity and freedom to elaborate on key areas. The objectives of the interview sessions were to learn more about the individuals' and the companies' skills, capabilities, collaborations and contributions to the technology development and the business development processes.

Based on the interviews conducted by the authors, the paper describes the impact of forming collaborations and networks for the purpose of developing an integrated product-service offering (IPSO).

All interviews were transcribed and a case report is currently being written. Since the respondents are still in a phase of active work, the case report has not yet been shared with them, and therefore the data has not yet been validated. Even though the research work conducted is still a work-in-progress, some interesting preliminary conclusions can be drawn.

## 4 LITERATURE REVIEW

### 4.1 Product/Service Systems

Product/Service Systems (PSS) owes some origin to the emerging Service Economy in which both physical products and technology are means of providing functions. Instead of adding value through revamping or improving production processes, value is added by "servitising" products—in other words, integrating services with physical products. Some examples of such integrations include user training, technological improvements such as new software versions, aesthetic design, etc. (all intangibles) [8]. The main idea in PSS is that *function and utility* are key to customers' satisfaction, instead of the physical product itself. Thus, it can be considered that the concept of PSS depicts a shift from selling products to selling services.

The development of this concept addresses two important aspects of how the provider company's strategies should be designed—the business aspect, and the environmental aspect. Considering that today's customers demand more and more services, companies should realise that substantial revenue can be earned when a product life cycle is extended, not by selling more pieces, but by providing more services that are of value to the customer. Business developers can make use of environmental concepts (such as eco-design or EMS/environmental management systems) as corporate strategies, thus affecting business strategies and decisions in a more substantial manner [7]. From the business/economic point of view:

- The company should have a holistic perception of the whole production system (from product development, to customer use, and management of the used products) [7];
- Production of an offering focuses on value creation and utilisation of the offering, instead of producing a physical product; and
- Company activities that can contribute to this concept include service and repair, recycling, upgrading, re-manufacturing, and refurbishment [7].

From an environmental point of view, PSS has the potential to alter production and consumption patterns that might lead to more sustainable practices and societies [8]. It considers sustainability and the impact production has on the environment, by addressing efficient utilisation of resources. Specifically, PSS attempts to prolong the total life cycle of the product, with the least possible use (and/or re-use) of resources

Proponents of PSS argue that adding services to products can extend the product life cycle [9], and that companies can earn substantial revenue when the product life cycle is

extended. However, there are hurdles to overcome with regards to adopting PSS:

- The readiness of companies to adopt the PSS concept, i.e. operating costs might increase as companies are now the owners of the products; and
- The readiness of consumers to accept the PSS concept, i.e. consumers might not be enthusiastic about ownerless consumption

Even at the strategic level, it is not clear what the extent of the service offer should be, or what factors to consider when deciding on a product-service mix [9].

It cannot be denied that it will require different societal infrastructure, human structures and organisational layouts in order for suppliers to realise the full potential of PSS in minimising environmental impacts of both production and consumption. In short, the complexity of the development process increases. One way of changing production, product usage and consumption patterns is to *create business solutions that present a different relationship to the consumer* than that offered by the traditional sale of products [7].

For example, to be able to deliver "new" services, companies need to continually develop their value chains and the competence of their staff, especially the ability to manage a new relationship with the customer [8]. This is because the added services requires of a company bureaucratic changes, structural changes and processes new to the producers [9]. The transition to Product/Service Systems also places new and demanding requirements on development and production of the product and service, along with new requirements for companies in the way they relate to and build relationships with their customers.

The PSS concept has the potential to offer a new way of understanding and influencing stakeholder relationships and viewing product networks, which may facilitate development of more efficient policies [8].

### 4.2 Network-building

From the study of business organisation, we can trace two related fields which hold two contradicting ideas: organisational theory and strategy management. Organisational theory studies state that the organisation is often embedded in its environment. Thus its actions and behaviours are greatly constrained by its environment. Strategy management theories, on the other hand, suggest that the opportunities exist for the organisation to control its own behaviour and assume that the organisation possesses the freedom to make its own choice [10].

Strategy management scholars make three assumptions of the organisation:

- 1 Organisations are affected by external factors;
- 2 Organisations have to use their internal capabilities to counter these external factors; thus
- 3 When environmental conditions change continuously, organisations need to adapt continuously to these changing conditions.

Networking and forming collaborations are just some of the sub-disciplines within strategy management.

The network model originated in the mid-1970s at the University of Uppsala. A network is defined as "...a set of high-trust relationships which either directly or indirectly link together everyone in a social group" [11]. The fundamental components of a network are the nodes and the connections. The nodes in a network are represented by actors or players. These actors (or players) can consist of individuals, organisations and institutions. The connections are usually the social ties and relations that connect the various actors in the network [12]. The

network construct basically provides a picture of the inter-organisational relations that are maintained between various actors in its environment.

The network model puts forward three observations:

- Business organisations often operate in environments which include only a limited number of identifiable organisational actors;
- These actors are involved in continuous exchange relationships with the organisation; and
- In such cases each individual party exerts considerable influence on the organisation.

Pöyhönen and Smedlund [13] identified three types of networks, placing special emphasis on knowledge-creation with respect to the three:

- a *production network* assumes a hierarchical structure, where the leader of the network finds his place at the top of the network structure, and knowledge flows only one way, i.e. top-down (e.g. a bureaucracy);
- a *development network* is pictured as being rather flat and proposes all network actors to be empowered. Thus knowledge sharing can move in any direction, but always in a horizontal fashion (e.g. in task forces); and
- in an *innovation network*, information moves in a chaotic and sporadic fashion and connections are established between as many members as possible. For the innovation network, personal networking skills are given preference over individual power of the respective actors (e.g. new venture creation).

They conclude that in a knowledge-producing organisation, all three networks are utilised.

The relationships (linkages) between the actors are generally continuous over time, rather than being composed of discrete transactions. Routines strengthen the interdependencies between the two parties. Through these relationships, either party can gain access to the other's resources. To some degree, actors can therefore mobilise and use resources possessed or controlled by other actors in the network. Actors can use the existence of "complementarity" or competitiveness in their relationship in different ways, as they interact with one another. The establishment and development of an inter-organisational relationship requires a "mutual orientation" [10].

Leiserson states that actors having the same ideology have a higher possibility of forming a more successful network, as these actors possess similar attitudes and characteristics [14]. Within this opinion, communication is essential in order to allow network actors to identify partners who are most compatible and likely to contribute to the success of the network. However, Karathanos brings forward the idea of coalition as a "means-oriented alliance among (actors) who differ in goals" [14]. This opinion is appreciated especially when most research indicates that partner selection is always based on a pre-supposed "fit".

By the 1990's, the network approach has become the basis for new organisational forms [15]. In today's economy, networking has become the rule, rather than the exception, and reflects the appropriate way of communicating and organising resources for today's companies. It demonstrates how individual actors create and manage alliances among themselves as strategic responses to counter competitive forces and innovative uncertainties [13]. This is especially applicable to small and medium-sized organisations that lack resources and skills critical for them to develop and expand.

## 5 CASE STUDY

### 5.1 The Integrated Product and Service Offering (IPSO)

The IPSO in this case is based on:

- The Build-Own-Operate (BOO) concept, where the joint venture (JV) company takes responsibility for the design, builds and operates the water treatment plant at the customer's facility.
- The new technology process extracts chemicals from the water sludge waste. The water sludge waste (which is actually the facility's waste product) is free for the JV company.
- The chemicals extracted become raw material and is re-sold to the customer facility for use in their production process. The cost is regulated by the contract to be a certain percentage of the market price of the chemical. The facility is obligated to purchase the chemical from the JV company.
- The main motivation for the facility to be interested in the IPSO includes disposal of the sludge and the reduced costs for handling sludge waste. Other factors include environmental laws, costs for storing of the water sludge waste and lower raw material costs.

### 5.2 The Inventor

The Inventor is the initiator and inventor of the technology used in the chemical extraction process in this case. Currently, the Inventor holds two patents for this technology. The patents were taken over by Company 2 in exchange for financial backing in order to further develop the technology. At the same time the patent was acquired by Company 2, the Inventor was also employed as an independent technology consultant for Company 2.

### 5.3 The participating companies

The following summarizes some information regarding the companies and their motivations for participating in the joint venture:

#### *Company 1*

Company 1 is an engineering company and the appointed supplier to the JV company. Their main business is providing consultancy services within the energy industry. Their role in the JV company is to develop and deliver the technology, thus Company 1 is known as controlling the "heart" of the applied technology. Company 1 holds a critical role in the development project, and works extensively with Company 2 to develop and test the technology during its development phase

Company 1 owns the least amount of shares in the JV company.

#### *Company 2*

Company 2 is in essence, a chemical supplier. They own the technology used for the chemical extraction process. They acquired the technology from the Inventor (of the technology, and who was the one who originally filed the patent on the technology) in exchange for financial assistance. Following the acquisition of the technology, the Inventor was also hired as an external consultant in Company 2 in order to continue working on the technology.

Company 2 later became the major shareholder in the established JV company, and thus assumes most of the project leader role.

#### *Company 3*

Company 3 is physically located in the emerging market, in which the newly established JV company aims to offer its newly developed IPSO. It was Company 3 that

originally spotted the opportunity and potential in bringing the extraction technology to the emerging market. Company 3's main role in the collaborative development project and later the JV company is their presence and knowledge of the emerging market. More precisely, Company 3 acts as the agent between the JV company and the clients, as they are the ones with the direct connection to the clients.

Ironically, Companies 1, 2 and 3 previously found their connections through key actors, who at different points of their lives were acquaintances and colleagues.

#### *Company 4*

Company 4 is a venture capitalist that joined the JV company at a later stage. At that stage, the technology development was nearly completed, and the other three companies were looking to build a full-scale plant. Keeping in mind the business side of the development, Companies 1, 2 and 3 agreed to seek assistance from Company 4. The main role of Company 4 here was threefold: (1) to assume some of the financial risks associated with new venture creation, as well as (2) to provide legal guidance in the establishment of the JV company and (3) to give support in entering the emerging market.

#### *Local partner*

There is also a local partner from the emerging market who has been actively involved in the business development process. The partner has local knowledge of the customers and their needs, knowledge of the local culture and how to perform business in that market.

### **5.4 Testing the technology**

During the development of the technology, preliminary tests were conducted locally in Sweden. These tests plants were small and portable, which means they were transferable from one location to another. Most importantly, the tests produced encouraging results. The early-stage development tasks and tests were personally funded by the Inventor.

Once the patent was bought over by Company 2, a pilot facility was built and another test was conducted at a larger scale. This test was funded 50/50 by the Inventor and Company 2 and took place in the emerging market.

This was the JV company's first step towards entering the emerging market, i.e., a natural progression was to test the technology on site, at the customer's facility in the emerging market. This also resulted positively, and a plan was devised to build a full-scale plant and begin implementing the technology (in the emerging market).

Currently, the technology is at a stage where the technology is to be implemented for actual use in the process industry.

## **6 DISCUSSION AND ANALYSIS**

The main purpose of this paper is to analyse and learn more about the two networks that developed in the process of developing the new technology and the IPSO,

followed by the process of bringing the new technology to the emerging market. Some issues that were addressed include:

- partner selection and how the companies initiated the first contact;
- what kind of relationship existed in the beginning, and how has this relationship developed over the months; and
- what kind of communication were used in their dealings (was it open communication or closed communication); and
- what is the nature of these relationships now, in light of the challenges that the JV company is facing now.

For this case study, two types of networks were detected in the innovation process: a technology development network and a business development network.

### **6.1 Technology Development Process**

The technology development process is illustrated in Figure 1. The formation of the JV company began several years before (even before the JV company existed), as long-time friends and acquaintances who share common history, backgrounds and interests try to assist each other with developing a new technology. These relations were informal, and assistance came in the form of ideas and discussions (between the Inventor and his former colleague who currently works in Company 1), references and recommendations (as in the Inventor recommending Company 1 to Company 2 as the supplier) and lending of equipment (again between the Inventor and the Individual in Company 1) and so on; but never financial assistance. Most of the work and much effort occurred at the personal level, and relations and ties were based on friendship and trust built over long years before.

The JV company first assumed formal ties and shape after the technology was nearly fully developed. Contracts were created and signed by the respective companies involved in the JV. The first formal agreement was between the Inventor and Company 2, where the Inventor sold the patent to Company 2 in exchange for financial assistance in order to carry on his work on the technology. At the same time, the Inventor began official employment as a consultant within Company 2 so as to continue his development work on the chemical extraction technology.

As a consequence of this, Company 1 was appointed the dedicated supplier (as they had the "heart") to build the pilot plant. Coincidentally, Company 3 was scouting for this precise technology for implementation in the emerging market, and based on references and old-time friendship, landed at Company 2. Together, the three companies came together to formalise their agreement in order to develop the technology and bring it into a new market.

In the beginning, personal relationships played more important roles. But once the relationships were formalised, inter-organisational networks were of more importance.

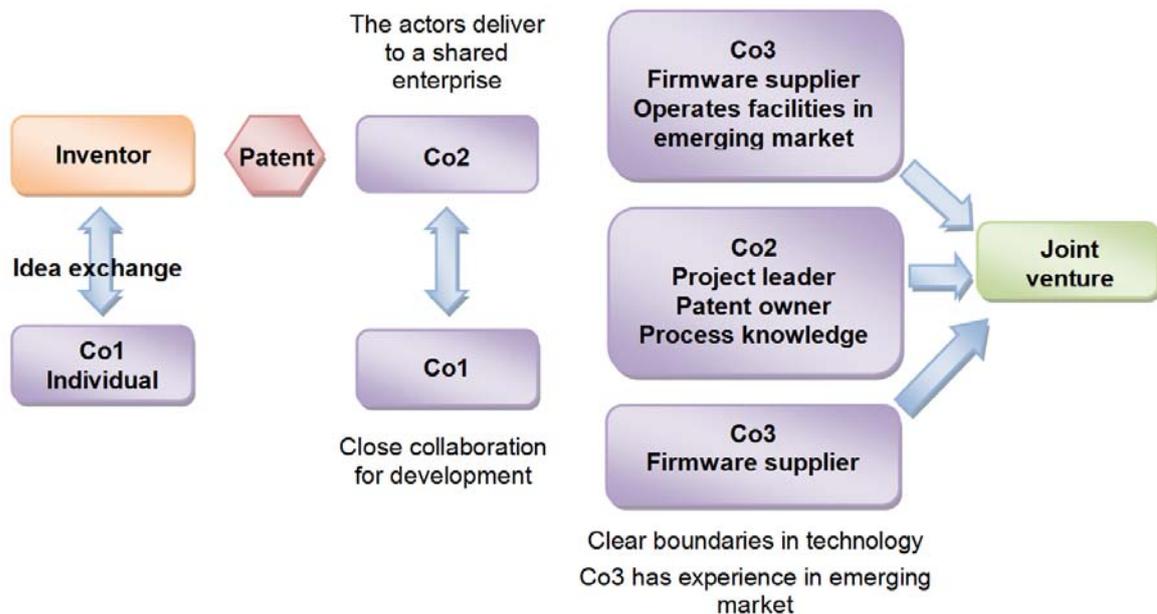


Figure 1: The Technology Development Process

It cannot be denied that the iterative work process between all the companies for developing the technology innovation went much smoother than expected. This is because all parties relied on long-time friendships and trust that they had built from past years. However, it should also be noted that the technology development is currently still an ongoing process, as the JV company has recently launched the first full-scaled pilot plant and is awaiting its results. As Leiserson and Karathanos states that common ideology plays a significant role—coalition formation is predicted to be more successful if members possess similar attitudes, even though respective parties differ in goals [14].

And that actors have the tendency to select and partner with other actors who are most compatible and likely to “grow” the network/company.

## 6.2 Business Development Process

The business development process is illustrated in Figure 2. The first business transaction was initiated when Company 2 purchased the patent from the Inventor. With this, followed a succession of business agreements and economic transactions that occurred between the companies in their efforts to develop the technology.

After acquiring the patent, the next step for Company 2 was to appoint a dedicated supplier (i.e. Company 1) to develop and build the facility in which the technology will be tested. What is interesting is that, Company 1 was contracted because of their assistance to the Inventor while he was developing the technology (prior to the sale of the patent to Company 2).

Coincidentally, Company 3 came into the picture when they were in search for this precise technology to be used within the process industry in the emerging market. Company 3’s main intention was to purchase the patent from Company 2, and become owner of the technology. However, Company 2 did not agree to sell the patent; and a loose partnership was formed, in which the three companies agreed to work together in order to bring the technology to the emerging market.

Once the technology development process was approaching the market launch phase, the three companies realised that they needed to formalise their existence, before entering the emerging market. For this,

they approached Company 4, whose specialty was in new venture creation in emerging markets.

Company 4’s main contribution was to provide legal advice and financial capital to the JV company. With the new addition, the formation of the JV company was formalised.

In the business development process a local partner was also active. Due to legal reasons the local partner could not (at this moment) be included in the JV. The local partner has an important role as he has local knowledge, both in terms of customer connections, as well as knowing required business procedures.

Due to legal reasons, a corresponding JV company was also established in the emerging market. However, this JV company is fully owned by the JV company which was formed in Sweden.

The way the business development process evolved was very different from the technology development process. Each step taken was discussed by all the companies and decisions were made based on a need that was beneficial to the partnerships. This is concurred by Håkansson and Snehota when they observed that the establishment and development of inter-organisational relationships requires “mutual orientation” [10]. Each addition to the JV-company was an asset and also a way for the JV company to create and to build alliances in order to counter competition and uncertainties [13]. Though many initial discussions began with informal relationships, these relations were formalised rather quickly. This reflects the quality of the relationships that have taken long years to build and develop [13], and played an important role in expediting the formation of the JV-company.

## 6.3 Network-building within PSS

Within the JV initiative, certain features of the PSS concept can clearly be observed.

The main objective of the JV company is to develop an integrated product-service offering (IPSO) using the PSS concept. In doing so, both parties (the JV company and the customer) address some obvious environmental issues, that is (1) to dispose of the water sludge waste, (2) in the most cost efficient method, (3) using techniques that are environmental-friendly. All these three features can be found within the water treatment technology which utilises the water sludge waste as its raw material in its water

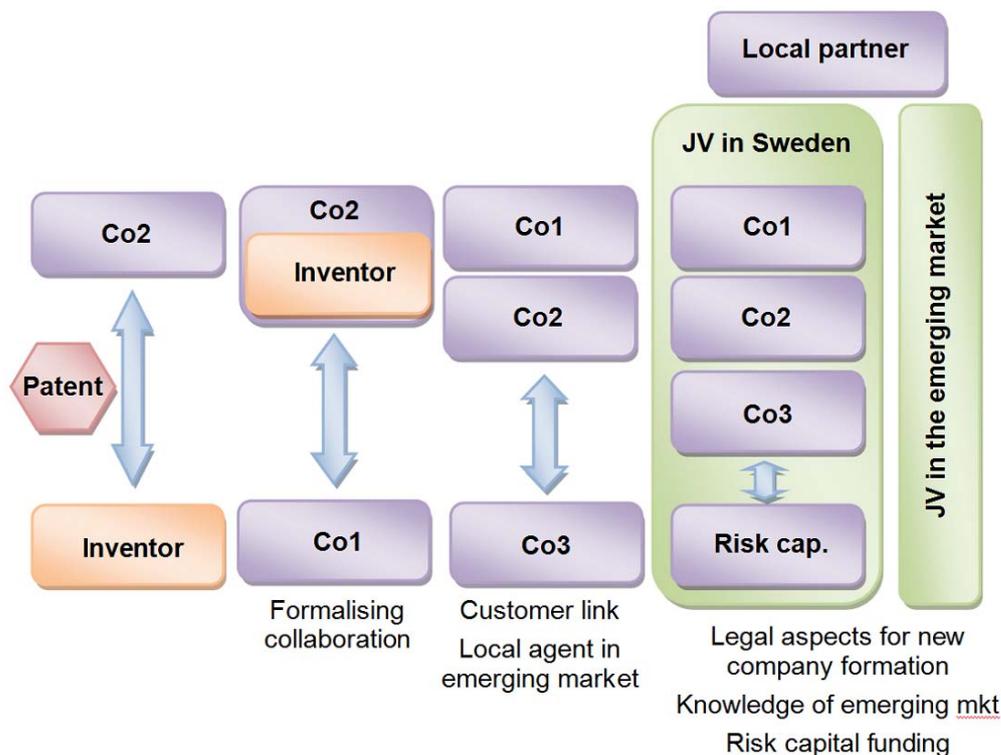


Figure 2: The Business Development Process

treatment process—the by-product of which is a mineral that will be sold back to the facility at lower-than-market price. This has obvious implications for the facility. Since the water treatment plant is built on the facility itself, the facility is now able to “nearly” eliminate the transportation cost that is incurred when disposing the water sludge waste. In addition, the plant now enables the facility to “generate” the needed mineral on-site, making the facility self-sufficient.

The pilot facility is to run for a test-duration of five years. At the end of this duration, the facility can choose whether to keep the water treatment plant running on its facilities, or discontinue the service obtained from the pilot plant and JV company. Should this option be chosen, the water treatment plant can easily be dismantled by the owners (the JV company) and transferred to another facility where it can again be re-constructed and operated in the same manner—thus taking care of the disposal costs of the water treatment plant.

It cannot be denied that the PSS concept compels us to view networks with a slightly different angle. This is because PSS has the potential to offer a new way of understanding and influencing relationships between actors.

The JV company was formed in order to exploit an opportunity of being first on the market using a completely new method in the industry. A decision was made to have an IPSO instead of selling the equipment and technology. By doing this, the JV company is able to shorten the time-to-market, as well as spread the risk amongst all partners involved. Furthermore, the process knowledge and technology knowledge would stay with the JV company. As described earlier a BOO approach has been taken.

The benefits for the customer include having to avoid dealing with the disposal of the water sludge, and the opportunity to purchase the needed chemical at a lower price than the market price. By doing this, the customer

- internalises some costs (especially depot costs for storing the water sludge waste);

- eliminates the cost of disposing of the water sludge waste; and
- reduces the delivery time and cost of purchasing aluminium by having the water treatment plant on site.

It should however be mentioned at this point that, the PSS concept does have some limitations. Firstly, the PSS concept is relatively new, and there is insufficient work carried out to capture and present successful PSS applications. Thus, there is no evaluation guide to examine whether a PSS is “successful” or not [21],[8]. Secondly, because companies do not have sophisticated theories and practices on maintenance and re-manufacturing model within the PSS, this poses many uncertainties and risks. Thirdly, a PSS evaluation tool is needed to guide customers in making decisions (what are their benefits, why should they decide for PSS, etc.)

## 7 CONCLUSION

It is clear that for small environmental technology companies developing and providing IPSO is a promising path for locating new business opportunities in new emerging markets. By approaching the customers with an IPSO and a total solution instead of offering part solutions or selling the technology many benefits can be achieved, among them:

- being able to expand businesses and penetrate new markets;
- get access to new customers by assuming more financial and technical risks;
- shortened time-to-market; while
- protecting the process and technology owner (as these valuable knowledge remains with the provider), i.e. the provider protects its know-how and technical core competence.

Competitive and sustainable PSS solutions can rarely be provided by a single company [21]. As seen in the case described, networking with partners complement each others’ own knowledge. In the innovation process for

developing and launching the IPSO the technology development process and the business development process have ran parallel to each other. In the two processes, different companies and different actors within the companies added their specific knowledge. An important indication of this is that, the companies need to learn how to promote their own skills, and at the same time, know where to find complementary knowledge. Besides this, the companies also need to learn how to act in and be part of a business-driven network.

When forming business-driven networks, the environmental context in which the respective actors exist [12] should also be taken into account. The network analysis was used to analyse the JV company as:

- it is seen as a form of co-ordinating asset-specific resources that were within the respective partners;
- the network/personal relations was/were used as a means to create and exploit opportunities, using close interactions; plus
- these relationships must be maintained in order to build social capital that is crucial for the success of future projects.

A knowledge-producing company utilises all three types of networks (a production network, a development network and an innovation network) [10] and the success of the JV company depends upon the partners' abilities to use the correct network construct depending on which stage of the development process.

The preliminary conclusions that can be drawn based on the development that has progressed within the full-scale pilot plant are:

- The concept of PSS facilitates innovation in multiple areas and various ways (i.e. in the technology and the business development);
- PSS has the potential to produce financial benefits; and
- By understanding integration of product and services AND being part of this network enabled the companies to identify new market opportunities and stay competitive at a global level. As a result, the JV company was able to produce a new technology in their field that could not have materialised, if done by only one party.

It is evident that PSS places importance on customer involvement as more focus is placed on the transition to service. In this research project, in the beginning of the technology development process, the customer needs were expressed directly through the involvement of Company 3, which was also the company who spotted the opportunity for bringing the technology to the emerging market. During the testing phase which is currently ongoing, the customer is very much involved in the development process, interacting on a daily basis for troubleshooting and problem solving purposes.

For future works, this project will focus on the results obtained from the full-scale pilot plant that has recently been launched.

## 8 ACKNOWLEDGMENTS

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