Innomerge

Uptime business models, frugal & reverse innovations for emerging markets

Project within “FFI - Transporteffektivitet”

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Content

FFI in short

FFI is a partnership between the Swedish government and automotive industry for joint funding of research, innovation and development concentrating on Climate & Environment and Safety. FFI has R&D activities worth approx. €100 million per year, of which half is governmental funding. The background to the investment is that development within road transportation and Swedish automotive industry has big impact for growth. FFI will contribute to the following main goals: Reducing the environmental impact of transport, reducing the number killed and injured in traffic and Strengthening international competitiveness. Currently there are five collaboration programs: **Vehicle Development, Transport Efficiency, Vehicle and Traffic Safety, Energy & Environment and Sustainable Production Technology.**

For more information: www.vinnova.se/ffi

1. Executive summary

The purpose of the project was to find new innovative business models for up-time offerings in India. It was a collaborative research project between academia in Sweden/India and Volvo with the ultimate goal to develop better technology and services to increase our customers' uptime in the value segment in India.

The project had two parallel tracks with regular interactions between them. The first track focused on working with service concepts and business models. The second track focused on technical details with objective to develop on board logging tool for collecting runtime vehicle data and performing frugal experiments for both predictive maintenance and fleet management services.

The project has majorly followed market-back approach, which is also called the Reverse Innovation process. The process starts by assessing customer's needs in emerging markets rather than assuming that the organizations just need to make alterations to existing products, strip down costs and alter offerings, keeping business operating model unchanged. We have enormous potential untapped in low-income segment or the so called Value Segment of the Emerging markets. Understanding market segmentation, with a deeper customer insight is needed for developing uptime service offerings which can add value to the customer business. The customers in value segment are sticker price driven and operation cost oriented. It is essential to get the customer insight for different market segment to develop suitable service offering.

Project started with a customer dealer insight and a market research at different regions of India for understanding the Indian commercial vehicle market and getting a deeper insight of value segment of emerging Indian market. Customers, dealers, fleet managers, truck drivers and technicians were interviewed with a set of questionnaires to understand their perspective of the market, needs, problems and expectations. Interviews were performed in all the four regions of India. The market research reports generated were used for developing service concepts that can address customer problem, enhance their business and increase revenue growth.

From the market research, customer insights & early impressions, baby concepts were developed for the service concepts. A detailed description of service concepts were made to capture background, requirement, value creation, business impact etc. Service concepts were prioritised based on input from product planning, technical feasibility, business impact and market acceptance & maturity. Volvo internal workshop with focus group from technical and sales team was held to get market and customer perspective for the concepts. The input and feedback from the focus group was used to further refine the concepts. Customer workshops for the prioritized service concepts were performed.

On the technical side three experiments were performed; the first was to characterize driver behavior for profiling of different drivers. This was partly a consequence of the

customer interview findings, that a driver pool would be useful but that there is a need to characterize a driver's performance. The second experiment was a load experiment to evaluate the feasibility of determining the load of a vehicle. The motivation behind this was that the vehicles are not instrumented with sensors/algorithms for load estimation; however there is a common problem of overloading the vehicles that can have a negative impact on uptime. This was identified as a possibility that is both relevant for the Indian market and challenging to achieve given that the target vehicles are trucks for the low-cost market segment with low number of sensors. The third experiment was a demonstration of how QR code technology can be used to convey information in a simpler way to the driver and also sending information from vehicle to back office in situations where telematics is not always available.

There have been two journal publications and four conference publications. All the conference publications have been peer reviewed.

2. Background

The Swedish based commercial vehicle industry is facing a number of key challenges in the upcoming decade including increasing low cost competition from competitors based in East Asia, major paradigm technology shifts in vehicle design and preferred fuel sources.

Growth opportunities in the traditional familiar markets are expected to be very low, reflecting the general macro-economic outlook in Europe and North America. The major growth opportunities are expected to be found in emerging markets. The local transport industry in these markets is typically entrepreneurial and innovative, but also fragmented with very high expectation on short return on investment time. As a result transportation managers are prioritizing low purchase price over high vehicle availability and lowest possible fuel economy and product life cycle cost. The consequences for the environment are increased CO2 emissions and a failure of the transport industry to reduce its share of global emissions.

For European manufacturers it has proven very hard to market premium products in this environment. For example, the European segment of the more than 1 000 000 trucks registered in China 2010 was approximately 5 000 vehicles (0, 5%).

It is important for Swedish manufacturing facilities and R&D departments as well as for the global climate that Swedish commercial vehicle manufacturers can facilitate a technology shift and a mind-set change in the transportation industry of emerging markets. This mind shift change need to promote an increased focus on Life cycle cost / earnings rather than purchasing price. It needs to promote the understanding of the value of high vehicle availability and low fuel consumption.

To facilitate this mind shift change – new business models for selling uptime – vehicle availability and for selling transport capacity/ton kilometre needs to be developed, along with technology to monitor and validate the business models.

It has been recognised that selling western premium vehicles on emerging markets can be disappointing in terms of market share. Customers for instance in India has been proving to be unwilling to accept the price levels for western brands. Even in the cases when it can be showed that the European vehicle might cost less from a total cost of ownership perspective the customers often choose a local brand because of the lower purchase price or greater familiarity with the brand. As a result western vehicles are mainly found in niche applications with very particular needs – such as dangerous goods transports.

Scaling down features and design low specification vehicles, using the same brand name has been proved a dubious strategy to penetrate emerging markets. The risks involved in hurting the brand name are considered too great. While the premium brands (Volvo, Renault) are allowed to continue to cater to the premium segments, the Volvo group have also, through acquisitions and strategic alliances acquired several new indigenous brands such as Eicher Trucks. The Volvo Group is in a joint venture with the Indian motor company Eicher. The JV is called Volvo Eicher Commercial Vehciles (VECV). The idea is to transfer some technology to these brands to increase their competitiveness, while at the same time utilize the Volvo Groups global development and purchasing organisation.

The project is to a large degree inspired by the concept of "reverse innovation", a term referring to an innovation seen first, or likely to be used first, in the developing world before spreading to the industrialized world which, as the name inclines, is the opposite of what the norm has been and still is to a large degree in the globalization that we have seen in the last decades.

Typically, companies start their globalization efforts by removing expensive features from their established product, and attempt to sell these de-featured products in the developing world. This approach, unfortunately, is not very competitive, and targets only the most affluent segments of society in these developing countries.

The process of reverse innovation on the other hand, begins by focusing on needs and requirements for low-cost products in developing markets. Once products are developed for these markets, they are then sold elsewhere even in industrialized markets at low prices which creates new markets and uses for these innovations.

3. Objective

The overall purpose with the project is to find new innovative business models for uptime offerings for emerging markets, based on on-board diagnostics and to develop a process for reverse innovation. In order to find suitable models, we need to build knowledge on how advanced technologies and business models can be transferred to an emerging

market context. The project focused on uptime and fleet management solutions as the main application area. The focus for the project is the Indian market and the so called "value segment" which is something that is emerging in-between the current mass market and the high-end and low volume Niche segment represented by European imports.

The main objectives of the project are:

- To develop new innovative service concepts in the area of safety, environment and uptime
- To develop new business models for how advanced technologies can be used on emerging markets in order to speed up the adoption of more sustainable truck solutions
- To develop cooperation with Swedish and Indian academia.
- To transfer the business model results to Volvo and its joint ventures.

4. Project realization

4.1 WP1: Project Kick-off

There were three cornerstones of the project:

1. Successful export and solution sales to emerging markets
    a. How can Swedish export firms understand Indian customers to see beyond low purchasing price?
    b. How to get customers to consider "life cycle costs"?
2. Predictive maintenance technology
    a. How to utilize Swedish expertise and enable new technologies on emerging markets?
    b. How to predict breakdowns of low spec vehicles?
3. Frugal & reverse innovation
    a. How to develop low spec technology in Sweden suitable for the needs of India?
    b. How to transfer knowledge from emerging markets back to mature markets?

4.2 WP2: Market Insights

To understand the Indian market challenges, interviews were performed with Volvo, Eicher, Mahindra Navistar, Asia MotorWorks (AMW), TATA and Ashok Leyland (AL) customers. Main findings were:

- Majority of the owners are uneducated
- High focus on initial cost rather than total cost of ownership
- Vehicle financing is key, as not all the leading financers are giving a support for vehicles which are new to the market
- Government policy on emission standards is making all the owners to get their vehicles serviced at authorized service stations
- Unavailability of local mechanics who can repair a vehicle which is new to the market

- Unavailability of the driver is one of the key factors
- Driver unable to communicate the problems and issues correctly to owner or technician.
- Factors considered before buying a truck: Fuel Efficiency, Mileage, Service Network, and Resale Value.

4.3 WP3: Customer insights - survey-1

In total 70 interviews were performed in eleven regions around India: Vijayawada, Ahmedabad, Surat, Jamnagari, Kodad, Nagpur, Jamnagar, Singrauli, Kolkotta, Asansol and Dhanbhad. Target group: Truck Driver, Fleet Owner, Technicians and Managers of Service Centre.

4.4 WP3: Customer insights survey- 2

The purpose of this second survey was to understand underlying customer needs, purchase behavior and the customers view on services related to uptime, traffic safety and financing in general in the Indian value segment. The target groups were dealers, service points and current and potential customers in representative regions on the Indian market for both Volvo and VECV (New Delhi, Mumbai, Bangalore and Chennai). Total number of interviews performed is 26.

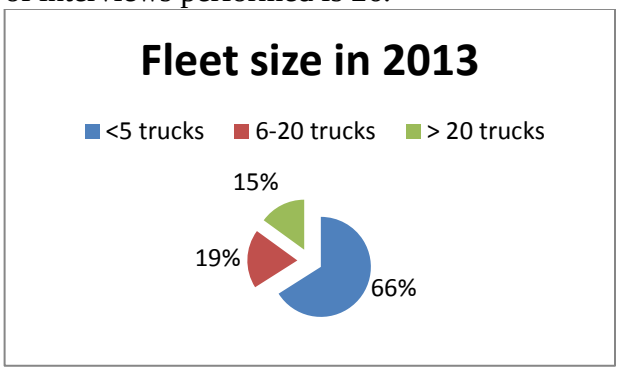

Figure 1 Fleet size share in India

Indian customers are much cost conscious, besides the focus on purchase price; the biggest cost is fuel consumption. Fuel is not so much of an environmental concern, but a cost concern, 50% of all cost is related to fuel consumption.

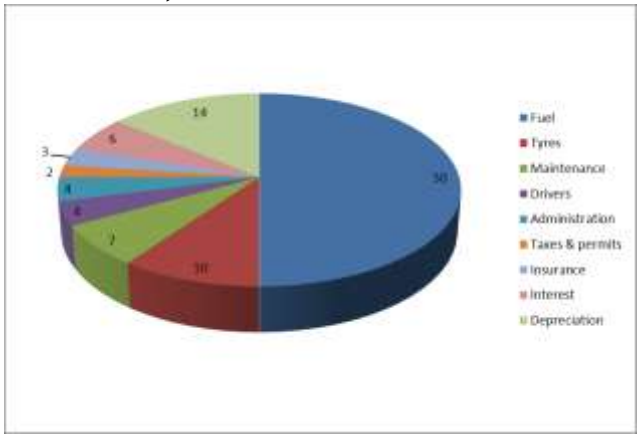

Figure 2 A typical road transport cost breakup

4.5 WP4a: Business Model Development

For the purpose of the project, we have explored upon an illustrative conceptualization of business models developed by Mason and Spring (2011). They draw upon some of the key features of business models and identify three principal dimensions through which a business model can be described. These dimensions are; market offering, technology, and network architecture.

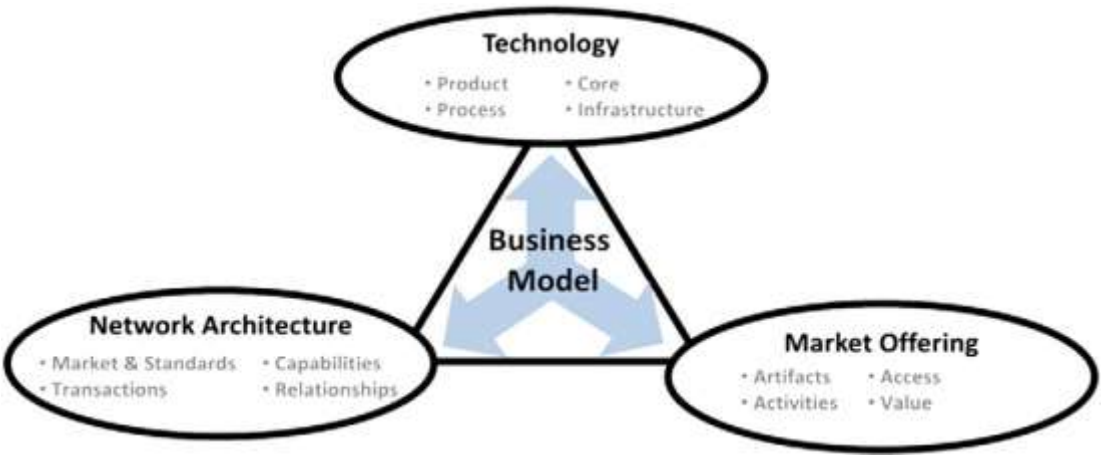

Figure 3 Business model elements (Mason and Spring (2011), p. 1034)

The market offering targets the ways in which value can be provided to customers. As such, it constitutes of both products and services. Following Normann (2001), the market offering is conceptualized as "not a physical product, but a way to reconfigure activities and stimulate and enable value creation" (p. 119). Value can be seen as the benefits derived by a customer from an exchange. It is considered key to understand what customers actually value, both today and in the future. Even though value can be created in a variety of different ways, the transfer of ownership of artifacts is still central to many business models. Furthermore, the artifacts might be involved in related episodes of access and activities, two other key aspects of market offerings. Access involves allowing the customer to retain ownership to some socio-technical capabilities; for example it-solutions. Activities concern what a company does for a customer as part of the market offering, often related to the notion of services. Such activities are, among other, seen as opportunities for differentiation and additional profits.

Technology is the usage and knowledge of tools, techniques, systems, and methods of organizations or material products (Kremer, 1993). Besides product technologies, Mason and Spring (2011) argue that a business model analysis also needs to take into account three other classes of technology; process, core, and infrastructure. Process technologies are used to manufacture products and to deliver services. Core technologies are those that underlie specific product technologies. Finally, infrastructural technologies enable connections, for example via the Internet or other communicative networks.

Network architecture highlights the relationships between the focal firm and the counterparties with which it interacts. Through such relationships, capabilities are attained, recognized as the knowhow of different organizations. To which extent a firm can access the capabilities of its network counterparts depends on the existence and development of markets and standards. Moreover, the actual transactions established between the counterparts need to be complemented also by non-financial exchange and interaction.

Taking departure in the conceptual understanding of business models proposed by Mason and Spring (2011), business model development in relation to the Innomerge project was done by relating to the specific market situation of Volvo in India.

4.6 WP4b: Service concept development

In this phase, service concepts were developed from the market insights. Service concept was built by careful evaluation of customer desirability, business viability and technical feasibility. This work package also includes elaborating the service concepts, required producer-user interaction, technological/resource requirements, business network, and implementation. Around 20 service concepts were identified initially. Multiple discussions and interactions were held within the organization for prioritizing the initial list of service concepts. Based upon internal prioritization, three service concepts were chosen for further development and description.

4.6.1 Driver pool service offer description

Driver pool service is about providing customers with a pool of drivers that fit their specific need. The driver pool will be designed to help the customers avoid the difficulty and frustration associated in finding trained & educated drivers. The drivers will be trained by the OEM's competence development group. Customers have many options to employ qualified drivers for short-term, long-term, part-time, full-time assignments, local, regional, temporary and permanent positions

Drivers from the pool will be trained on

- Efficient driving practices
- Routes & Geography,
- Road safety, Fuel efficiency & traffic safety,
- Permit & Taxation rules relevant to border.
- Technical knowledge of the vehicle,
- Defensive & Economy driving skills,
- right attitude for a safe & efficient driving,
- Awareness of good health and fitness.

4.6.2 Fuel monitoring service

Fleet manager and driver of the truck are the main stake holders in this system. The major requirements from the driver and fleet owner are provided in the table below.

Fleet manager	Drivers
• Easy to understand the information • Present all relevant data for each driver/ vehicle in one view – "one click" • Follow up on both driver & trucks • Comparative reports • Position of trucks, to know estimated time of arrival at customers etc.	• Clear visibility of cluster • Easy to understand and to learn interface of cluster • Easy to navigate and few levels in information structures • Pictorial representation of data • No distraction from driving • Positive and informative instructions while driving to support driving behavior to fuel efficient driving. • Personal account with post-trip information and instructions about their driving

4.6.3 Predictive maintenance service

The service is developed using logged vehicle data and telematics infrastructure .The vehicle signals are analyzed using the algorithms at back office and anomaly is observed and predicted as potential problem or failure. This prediction can be offered to dealer for business opportunity. The service is offered to large fleet owners so that they can manage the fleet in a better way and avoid unexpected downtime.

Dealer buys service which interfaces with the back office. It alerts on any possible failure about the vehicles in his coverage area or vehicles which have regular service contracts. Then dealer can choose to decide the plan of action to communicate to the customer (fleet manager/Driver). Dealer through the call center setup can guide the truck for appropriate actions.

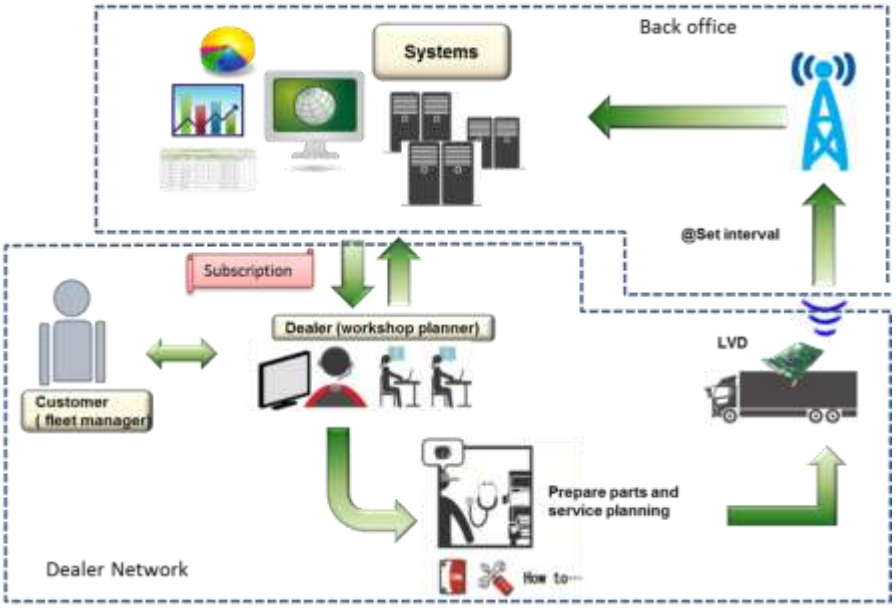

Figure 4 Representation of the predictive maintenance service concept

4.7 WP4b: Customer Co-Creation Workshop

Customer co-creation workshops were performed to understand the customer desirability and acceptance for the service concept and evolve the service idea together with the customer.

Step 1: A very high level briefing of the project and the two service concepts were given to the customer.

Step 2: Understanding the problems and needs surrounding each of the service concepts.

Step 3: Present the service concept through visualization (movie)

Step 4: Step by step evolution of the concept combining the input received from step 2 and our proposed service idea in step 3.

4.8 WP7 – Reverse innovation

This work package is described in a separate document as work performed by Chalmers University of technology.

4.9 WP 5, 6 and 8 – Technical development

The work package 5, 6 and 8 dealt with logging on board data from real truck, developing algorithms for analyzing data and performing selected experiments.

4.9.1 Driver profiling

Data was collected for two drivers that both have about 12 years of professional driving experience of trucks. The instructions to the drivers were simply to drive systematically both normally and badly in both a city but also in a highway setting near Kolar in India. This means the drivers had to interpret themselves what does it mean to drive badly for the particular road/traffic conditions in India. For the highway tests the vehicles were also driven both with and without a load in the vehicle, all combinations that were driven are shown in table below where each combination was driven for about one hour. For each combination, all data was collected with a sampling rate of 4 Hz.

Driver #	**Driving style**	**Driving environment**	**Load**
D1	Normal	Highway	With and without
D1	Normal	City	With
D1	Bad/Rash	Highway	With and without
D1	Bad/Rash	City	With
D2	Normal	Highway	With and without
D2	Normal	City	With
D2	Bad/Rash	Highway	With and without
D2	Bad/Rash	City	With

4.9.2 Load experiment

Five different experiments were performed to collect data from different scenarios where it was considered feasible to estimate the load of the vehicle. The driving experiments were as follows:

Driving Style 1

Driving the truck for a stretch of 1 km as follows:

Step1: Drive the truck from speed 0 to 20 kmph for a distance of 100m

Step2: Drive the truck from speed 20 to 30 kmph for a distance of 100m

Step3: Drive the truck from speed 30 to 50 kmph for a distance of 200m

Step4: Drive the truck from speed 50 to 70 kmph for a distance of 600m

Sl. No	Driver Description	Driving style	Driving Environment	Load
1	Any Driver	Normal	Long haul (High Way)	Without

2	Any Driver	Normal	Long haul (High Way)	Average
3	Any Driver	Normal	Long haul (High Way)	Maximum

Driving Style 2

Drive the truck with a constant speed of 40 kmph on uphill for 1 km (Note: Fuel consumption and accelerator pedal position signal will be observed)

Sl. No	Driver Description	Driving style	Driving Environment	Load
1	Any Driver	Normal	Uphill	Without
2	Any Driver	Normal	Uphill	Average
3	Any Driver	Normal	Uphill	Maximum

Driving Style 3

Step1: Drive the truck uphill to reach speed of 50 kmph

Step2: Once the 50kmph is reached continue driving uphill for another 500m with a constant accelerator pedal position.

Note: The vehicle will slow down and the amount of slowdown can then be observed)

Sl. No	Driver Description	Driving style	Driving Environment	Load
1	Any Driver	Normal	Uphill	Without
2	Any Driver	Normal	Uphill	Average
3	Any Driver	Normal	Uphill	Maximum

Driving Style 4

Drive the truck starting from standstill and try to reach 50 kmph as soon as possible.

Sl. No	Driver Description	Driving style	Driving Environment	Load
1	Any Driver	Normal	Long haul (High Way)	Without
2	Any Driver	Normal	Long haul (High Way)	Average
3	Any Driver	Normal	Long haul (High Way)	Maximum

Driving Style 5

Drive the truck is a way to reach the maximum speed for each of the gear from 1 to 8.

This is to calculate the maximum speed that can be reached based on different load for each of the gear

Sl. No	Driver Description	Driving style	Driving Environment	Load
1	Any Driver	Normal	Long haul (High Way)	Without
2	Any Driver	Normal	Long haul (High Way)	Average
3	Any Driver	Normal	Long haul (High Way)	Maximum

4.9.3 QR Code demonstrator

A prototype was developed regarding how diagnostics information can be shown to driver using QR Code.

5. Results and deliverables

5.1 Delivery to FFI-goals

Programme targets:	**Contribution:**
How well the project satisfies the targets defined within transport, energy and environmental policy	The service concepts and technical solutions together with business models around it will enable larger uptime and better usage of the low cost trucks in India. The results regarding customer mind-sets can also be useful for other industries in Sweden.
The ability of industry to operate knowledge-based production in Sweden in a competitive way	Succeeding in emerging markets and dealing with future low cost competitors from Asia entering the European market is the most important challenge for the Swedish vehicle industry. This project contributes in enabling shift towards relatively more modern technologies thereby lifting the market to more level playing field.
Contribute towards a vehicle industry in Sweden that continues to be competitive	
Leads to industrial technology and competence development	Significant contribution, new business models for uptime and pay for performance on emerging markets are developed.
Contribute towards secure	The strong R&D organization in Sweden builds premium

employment, growth and stronger R&D operations	technical products. However, it is important to capture new markets and this project attempts to lift the maturity of products in emerging markets with India as an example. This means industry in Sweden no longer need to depend only on mature markets like North America, Europe & Japan.
Support environments for innovation and collaboration	The cooperation with Indian academia promotes industry and academia collaborations. The emphasis on reverse innovation contributes to a knowledge transfer culture in both directions. There are already ideas for further projects
Strive to ensure that new knowledge is developed and implemented, and that existing knowledge is implemented in industrial applications	The results from the service concepts and technical results will be spread to the respective product development organization. And the knowledge gained in the project will be the basis for starting new projects for the value segments within Volvo.
Reinforce collaboration between the vehicle industry on the one hand and the Swedish Road Administration, universities, colleges and research institutes on the other	Strong team. Project including research & industry partners. Potential for Swedish authorities to disseminate knowledge to counterparts in emerging markets.
Also describe the extent to which the results from the project may be of direct or indirect relevance for other manufacturing industry.	The trend to move towards solution selling and pay for performance is evident in many different manufacturing industries. So is the need for emerging market growth. The dissemination of knowledge from academic partners will ensure that this knowledge is properly communicated.
Strive to secure national supplies of competence and to establish R&D with competitive strength on an international level	International cooperation ensure international competitiveness

6. Dissemination and publications

6.1 Knowledge and results dissemination

The results from the project were presented to related people all over Volvo. Also, results around the service concepts were presented to the Volvo Eicher Commercial Vehicles organization in India.

The project was one of its first kinds within Volvo to collaborate with emerging market in the area of service concepts and business models. Apart from the valuable results, the knowledge gained during the process is extremely vital for engineers in Sweden to

collaborate with counter parts in India. Both Chalmers and Halmstad University has expressed deeper understanding on the Indian market.

A technology readiness assessment was done at Volvo for selected concepts and we have fulfilled "TRL" level 4 in some areas. In order for easier understanding of two of the prioritized service concepts, considerable efforts are put in visualization and there are power point based animation films available to be run on demand.

6.2 Publications

Bankvall, L., Dubois, A. and Lind, F., 2013. *Alternative business models for trucks – considering network embedded market offerings*. The IMP Journal Seminar, April 11-12, Marseille.

Bankvall, L., Dubois, A. and Lind, F., 2013. *Business Models: Change of Scope and Scope of Change*. The IMP Conference, August 30-September 2, Atlanta.

Bankvall, L., Dubois, A. and Lind, F., 2013. *Business Models for Trucks*. The NOFOMA Conference, June 3-5, Gothenburg.

Bankvall, L., Dubois, A. and Lind, F., 2014. *Towards a Network-based Business Model Concepts and The Case of a truck OEM considering its Business Model in India*. The IMP Journal, 8 (2), 44-50.

Bankvall, L., Dubois, A. and Lind, F., 2014. *An Industrial Network Approach to Business Model Innovation.* In proceedings for Industrial Marketing Management.

Bankvall, L. and Lind, F., 2014. *Exploring Reverse Innovation – A Study of a Truck OEM in India*. The IMP Conference, September 1-6, Bordeaux.

7. Conclusions and future research

There is a need for long term vision for aligning technologies to service development. There is a need for assessment of service readiness level (similar to technology readiness level "TRL"). For Swedish industries to succeed there are organizational challenges when collaborating with India counterpart specially when there are joint ventures. For example, contact network with dealers and customers has to pass through many levels. There is unrevealed potential for joint research with emerging markets.

Indian/emerging market moves very quickly and Swedish industries need to be fast, flexible and frugal to launch solutions. Network with India academic is established. Discussions are ongoing regarding ideas for project call from Vinnova with focus on embedded system for Swedish and Indian cooperation.

The service concepts “Driver pool” and “Fuel economic monitoring” can be piloted.

On the technical side, following would be possible to explore in future:

- What are the similarities/dissimilarities between vehicle fleets in Europe and India? Can knowledge generated from one fleet by an algorithm be transferred (i.e. used) on vehicles in a different market? Can we compare buses with trucks? This can be investigated with respect to oil service, compressors, wheelspeed sensors, etc.
- During the project’s end phase, value trucks have started to roll out in the Indian market. The onboard logging tool developed in the project can be introduced for collecting fleet data. With fleet data there is a possibility to quantify how useful the result is in discovering problems with a newly developed (fresh) vehicle.
- The possibility to take the findings in project further, i.e. is speeding the real “driver issue” in India? Is the estimating of “overloading” an important feature?

8. Participating parties and contact person

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