



Description of new business opportunities

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DELIVERABLE NO	DI3.1
DATE	15.05.06
WORK PACKAGE NO	WP I3: New business opportunities and identification
VERSION NO.	1.0
ELECTRONIC CODE	FILE DI3.1_NewBusinessOpportunities_final.doc
CONTRACT NO	507100 PROMISE A Project of the 6th Framework Programme Information Society Technologies (IST)
ABSTRACT:	This document provides a comprehensive overview of the business opportunities identified by the PROMISE partners. The description of business opportunities follows a three step methodology comprising the elements business identification, business model description, and market analysis. The main result of this document is the description of the first complete PROMISE business model, addressing the MOL scenario of Iveco / CRF.

STATUS OF DELIVERABLE		
ACTION	BY	DATE (dd.mm.yyyy)
SUBMITTED (author(s))	Gregor Hackenbroich	15.05.2006
VU (WP Leader)	Gregor Hackenbroich	15.05.2006
APPROVED (QIM)	Dimitris Kiritsis	15.05.2006

Revision History

Date (dd.mm.yyyy)	Version	Author	Comments
20.03.06	0.1	Simone Perlmann, SAP AG	Initial document setup and structure
24.04.06	0.2	Simone Perlmann, SAP AG	Partner contributions included
28.04.06	0.3	Simone Perlmann, SAP AG	Revised version
03.05.06	0.9	Gregor Hackenbroich, SAP Research	Version sent into review process
15.05.06	1.0	Simone Perlmann, SAP AG	Final version

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1 Purpose of this document

This document presents the business opportunities and the market perspectives explored in PROMISE during the first eighteen project months. Interlinked with the results produced by the research and the application cluster, the document focuses on the business development analysis and considers potential markets, business process parameters as well as products and their characteristics that potentially will be enhanced by PEID technology. Methodologically, this deliverable follows the overall approach that was described in DI3.2 (M12) and further refined in the overall exploitation approach in DI3.3.

The document shows that the identification and development of business opportunities has improved substantially over the past months. Some partners have well developed exploitation plans including a profound market view and a business plan. Other partners need more time to explore their opportunities. The main result of this document is the first PROMISE business model covering the MOL scenario of CRF.

While for the first time presenting a full PROMISE business model, the deliverable further clarifies the scope of exploitation within the PROMISE project. The identification of business opportunities, a market analysis, and major elements of a business model (value proposition and architecture of value creation) clearly belong to project exploitation. However, the description of the business revenue model (who pays what to whom) cannot be done within the project lifetime, as revenue planning activities go well beyond precompetitive research and do not seem to be eligible for public funding.

2 Document overview

The present document is organized as follows:

- Chapter 3 summarizes in brief the methodical approach that has already been introduced in the previous instance of the PROMISE rolling report M12. It embraces the three major steps of business identification, business model description, and market analysis
- Chapter 4 presents the description of each partners' new business opportunities, including the expected value proposition, following the approach briefly summarized in chapter 3. Each section starts with the partners' recent business model and is followed by a dedicated description of the expected value creation and Revenue model, referring to the partner's business model. Corresponding market views accomplish each partner contribution. Due to the different focus, academic partner contributing to this deliverable chose a more liberate approach with regard to structure and content.
- Chapter 5 briefly refers to the projects' impact on SMEs.

3 Fundamental elements of exploitation

In reference to deliverable DI3.2 (M12) and DI3.3, the overall PROMISE approach towards exploitation consists of the following three steps below. This methodical structure is the basis for each partner contribution presented in section 4.

1. Business identification: At first, business ideas or business opportunities have to be identified. This task requires some creativity to find out which benefits can be realised. However, it helps to analyse the impact of PROMISE technology to the company's value chain, the currently offered products and services, as well as services customers ask for.
2. Business model description: Once the business ideas or business opportunities are identified, they will be elaborated into complete business models, which is a structured, qualitative description of a business concept, including value proposition, Architecture of value creation, and Revenue model.

3. Market analysis: When the business model respectively business opportunity is understood and described, a dedicated market view surrounds it and gives additional hints regarding the potential market size.

While the following figure represents this approach following subsection illustrates the business model description more detailed. Further details concerning the exploitation effort taken within the project are to be found in the corresponding rolling report (see DI3.2).

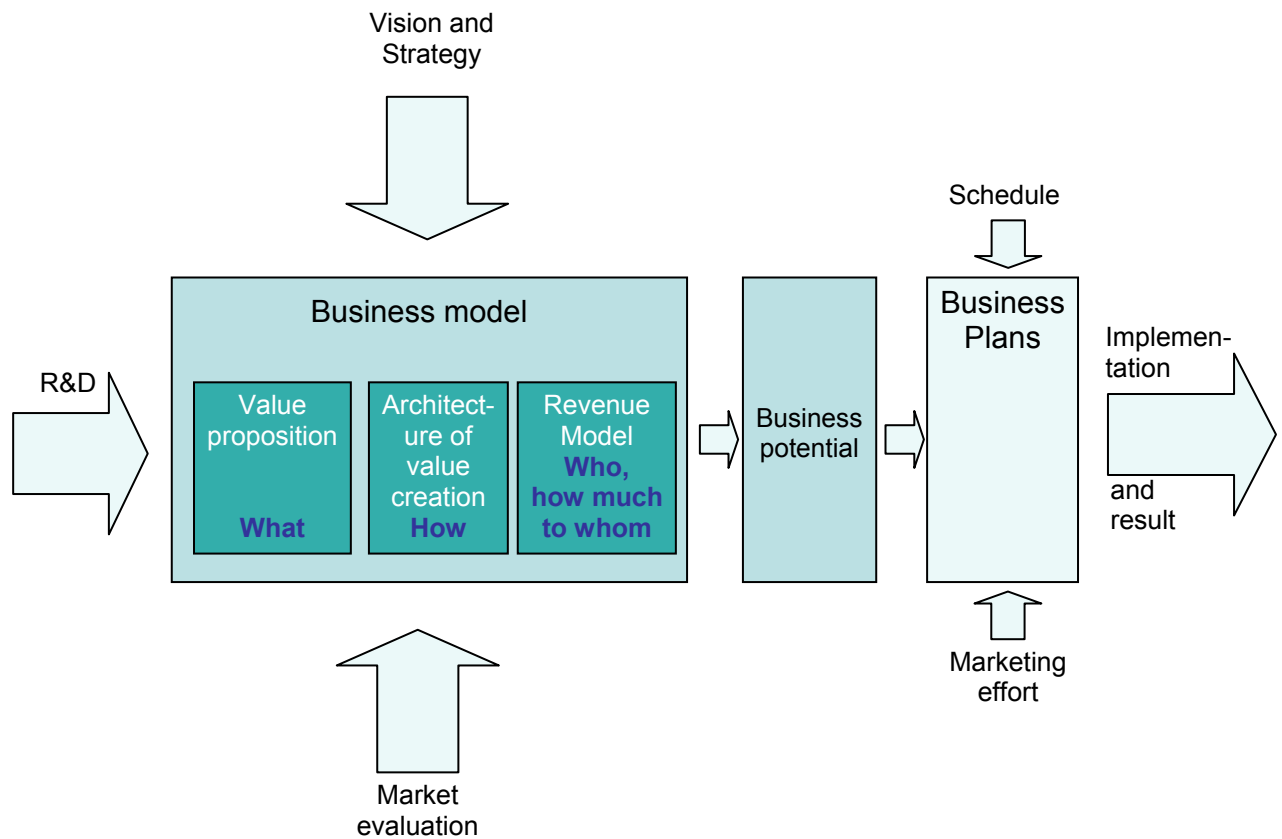


Figure 1: Exploitation approach chosen in PROMISE

3.1 Business model description

Business models are a systematic description of a company's business. The purpose of the description is to foster the understanding of how a particular business works. There are a number of approaches for business model descriptions which have been developed in economic research. Stähler [Stähler, 2002] distinguishes three parts of a business model:

- **Value proposition.** The value proposition of a business model describes the benefit that the business creates for its customers and partners. The value proposition basically answers the question what the business is doing. Typical value propositions in the area of PROMISE could be a higher availability of technical products or lower maintenance cost.
- **Architecture of value creation.** The second component of a business model comprises the value architecture. It explains how the benefit described in the value proposition is created. This includes steps of the value chain, involved partners and their roles, suppliers, distribution channels. In short, the value architecture describes the value creation process and all involved parties.
- **Revenue model.** Finally, the third component of a business model is the Revenue model. It contains a description of how money is earned in the business. It therefore answers the question on who pays how much to whom. It is important to give details on the pricing model, i.e. on which parameters the final price depends on. Especially services usually have more complex pricing models than products.

4 Identification of new business opportunities

The overall goal of this deliverable is to present the new business opportunities that have been identified within the frame of the PROMISE project. The following subsections provided by the various project partner show how the application of PROMISE technology can create a competitive advantage for each partner respectively how PROMISE technology can contribute to the partners value chain.

4.1 BOMBARDIER

Bombardier Transportation is a global leader in the rail equipment manufacturing and servicing industry. Its wide range of products includes passenger rail vehicles and total transit systems. It also manufactures locomotives, bogies, propulsion and controls and provides rail control solutions.

The business objectives of Bombardier Transportation are:

- Actively shape the rail industry as the leading global player
- Deliver on commitments to customers
- Strong financial results and profitable growth based on
 - Enthusiastic, committed and responsive people
 - Long-term stability
 - World-wide network of capabilities
 - Quality products and services that deliver value

The three product divisions Locomotives (LOC), Propulsion & Controls (PPC) and Bogies (BOG) are participating in PROMISE and are covering the complete traction chain of electrical locomotives, which is BT's main product examined in the PROMISE project. These three divisions are distributed over 13 sites in 8 countries within Europe, respectively 15 sites in 10 countries worldwide.

4.1.1 BOMBARDIER's business model

“Selling it right, designing it right, building it right, supporting it right...” Bombardier Transportation relies on clearly defined and integrated processes and systems at every step on the way to produce high quality, value-added products and services that meet the needs of its customers.

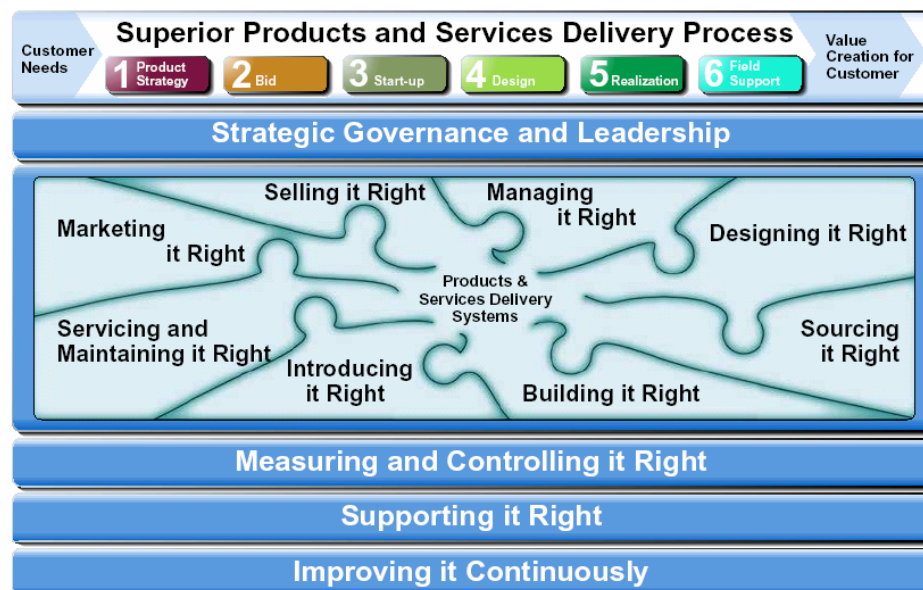


Figure 2: BOMBARDIER Transportation Integrated Processes and Systems

These integrated processes and systems include “Design for X” processes (DfX), which are basically a toolkit of best-in-class practices and processes which shall support the product design process and shall especially secure the fulfilment of special design requirements.

The product has to meet all kind of targets and specifications. Techniques are developed to ensure that the product meets these targets from the start. The generic process is for a lot of these DfX processes the same, and consists of a clear target break down, making people accountable for their portion of the target, a rigorous monitoring of the target forecasts and putting corrective actions in place where deviations are detected. This can be used for many challenging and measurable requirements such as Design for Weight, Design for Safety, Design for Noise, Design for RAM/LCC, etc. Another category of more qualitative requirements such as Design for Manufacturing, Design for Maintenance, Design for Testing, etc. shall be managed through cross functional teams and exchange of expertise.

4.1.2 Description of new business models

BT’s main interest in PROMISE technology is primarily to improve existing business models, instead of creating new ones.

The improvements shall be realised by providing DfX knowledge – which is transformed from real field data of products in service – to the engineers in a PDKM system to support the various DfX processes to be followed during product developments.

BT will first focus on the following selected and most important DfX processes:

- Design for Reliability, Availability & Maintainability / Life Cycle Costs (DfRAM/LCC)
- Design for Product Safety (DfS)
- Design for Environment (DfE)

4.1.2.1 Value proposition

The main benefit for BT is to establish a process (incl. supporting tools) for the transformation of field information into DfX knowledge resulting generally in:

- improved and more competitive product designs, mainly by adequate re-use of proven designs
- increased customer satisfaction due to improved fulfilment of customer requirements
- reduced design effort by allowing engineers to have direct access to discrete and meaningful DfX product data in every design phase
- minimized design changes during product service life (respectively warranty period) due to improved component selection during initial design

The impact on the considered DfX aspects are mainly:

(i) Impacts of design for maintainability and design for reliability knowledge

The improvement of reliability and maintainability through the use of design for maintainability and design for reliability knowledge increases the availability of locomotives which has the following benefits:

- decreasing maintenance costs related to labour, material and logistics;
- increasing the users’ satisfaction through the reduction of the number of serious incidents requiring maintenance;
- improving the marketing image of the company by emphasizing the availability performance of the locomotives.

(ii) Impacts of design for safety knowledge

The improvement of locomotives’ safety through the use of design for safety knowledge may have the following benefits:

- increasing the operators’ satisfaction thanks to the safety improvements on locomotives;
- reducing possible costs related to liability litigation problems by reducing the number of such problems thanks to the safety improvements regarding this type of problems;

- reinforcing the compliance with governmental regulations regarding safety requirements;
- improving the marketing image of the company by emphasizing the safety performance of the locomotives.

(iii) Impacts of design for environment knowledge

The improvement of the environmental performance through the use of design for environment knowledge may have the following benefits:

- reducing costs by decreasing energy consumption and by selecting efficient EOL alternatives for treating retired locomotives;
- reinforcing the compliance with governmental regulations and EU directives by environmentally friendly treatment of EOL locomotives, reduction of environment burden at the usage phase and by determining new material restrictions;
- improving the marketing image of the company by emphasizing the environmental performance of the locomotives.

The implementation of the PROMISE technologies will also provide positive effects for BT's business partners:

- **Customers:**

The customer (mainly locomotive operator) will mainly benefit from improved products regarding reliability, availability, maintainability and life cycle costs.

- **Suppliers:**

System suppliers will benefit from improved field information respectively knowledge regarding their scope of supply.

- **Partners companies / consortiums:**

Partners companies / consortiums will also benefit from improved field information respectively knowledge regarding their scope of supply.

4.1.2.2 Architecture of value creation

BT assumes that there will be a direct value creation only BT internally as shown in the value proposition above.

BT does not intend to sell neither the DfX tool nor the knowledge gained by it to other companies.

4.1.2.3 Revenue model

Revenue model					
Year	2006	2007	2008	2009	2010
A Revenue					
(i) Impacts of design for maintainability and design for reliability knowledge	0 €	0 €	197.300 €	237.300 €	277.400 €
(ii) Impacts of design for safety knowledge	0 €	0 €	77.500 €	77.500 €	77.500 €
(iii) Impacts of design for environment knowledge	0 €	0 €	57.500 €	57.500 €	57.500 €
B Cost/Investment					
No. of internal staff	1,3	1,8	0,8	0,8	0,8
Cost (per person)	138.320 €	142.470 €	146.744 €	151.146 €	155.680 €

Cost internal staff	179.816 €	256.446 €	117.395 €	120.917 €	124.544 €
Overhead (altogether)	17.982 €	25.645 €	11.740 €	12.092 €	12.454 €
No. of external staff	0	0	0,5	0,5	0,5
Cost (per person)	0 €	0 €	50.000 €	50.000 €	50.000 €
Cost external staff	0 €	0 €	25.000 €	25.000 €	25.000 €
Tool (hardware, software, maintenance)		12.600 €	13.200 €	13.200 €	13.200 €
C Saldo	-197.798 €	-294.691 €	164.965 €	201.091 €	237.202 €

4.1.3 Corresponding market view

BT assumes that there will be only an internal value creation, as given in the Revenue model above.

BT's figures:

- Workforce* 28,600
- Countries with Production Presence 21
- Production Sites 43
- Revenues** \$ 6.7 billion US
- Order Backlog* \$ 20.9 billion US

* as at 31 January, 2006

** year ending 31 January, 2006

4.2 CATERPILLAR inc.

CATERPILLAR inc. is the largest maker of construction and mining equipment, diesel and natural gas engines and industrial gas turbines in the world. Its products, services and technologies fall into three principal lines of business: Machinery, Engines and Financial Products.

CAT embraces:

Cat Dealer Network (200 dealers)

Cat products are sold and serviced through a worldwide network of nearly 200 independently owned dealers:

- 1,689 branch locations worldwide
- Nearly 100,000 dealership employees
- Average tenure 50 years, best in our industry
- Provide around-the-clock service to customers around the world

Cat Logistics (68 centers with 22 distribution centers)

- Provides integrated supply chain services to more than four dozen companies
- One of the largest integrated logistics organizations in the world
- Present in 40 countries on every continent
- Manages operations for more than 50 third-party client

Cat Financial

- A wholly-owned subsidiary of Caterpillar Inc.
- Provides a wide range of financing alternatives for Cat machinery and engines, Solar® gas turbines, other equipment and marine vessels
- Headquarters in Nashville, Tennessee
- Revenues of \$2.35 billion for 2005
- Operating profit \$537 million for 2005

4.2.1 CATERPILLAR's business model

Within PROMISE, CATERPILLAR focuses on heavy load vehicles designed, manufactured, shipped and commercialised by CATERPILLAR France.

CATERPILLAR France S.A.S. is specialized in the manufacturing of Medium size Track-Type Tractors from 90 to 149 kW, Medium size Track-Type Loaders, from 95 to 172 kW, Small Excavators, from 13 to 20 tons, Wheel Excavators from 13 to 20 tons and undercarriage components. CAT France key figures (2004) are:

- Employees 2430
- Incorporated Company with a capital of 125 M€
- Total property area 271 000 m²
- Turnover 223 M€
- Prime products 19

As PROMISE aims at implementing embedded devices and IT infrastructure onto the product to be able to manage its complete life cycle, other CAT businesses will be involved and will have business opportunities with the PLM of CAT machines, such as CAT Reman organization and CAT Dealers network in particular.

CATERPILLAR business model regarding **product lifecycle management** comprises:

- Sales of machinery (including CAT machines and engines)
- Services to final customers made by CAT Dealers network
- Exchanged market for engines with CAT Reman organization
- Sales of Certified Re-built machines made by CAT dealers
- CAT Logistics services performed for internal manufacturing processes and for supplying spare parts, machines & engines to final customers

The final customer satisfaction coming from:

- Best products with new technologies and solutions integrated onto the machines,
- Machine availability, reliability, and durability,
- Ownership costs for utility machine,
- Operating costs for production machine,
- Services for after sales support, rental, fleet management systems,
- Access to Reman components and / or Re-built machines.

Sustainability in the design and the life management until decommissioning of the product becomes also a sales argument.

In the business model, customer satisfaction is not appropriate, but marketing results will demonstrate the effects of new technologies on pins in the market, machines equipped with new functionalities (equipments, systems, services), benchmark comparisons to competitors. Business value could then be created from these marketing results.

4.2.2 Description of new business models

New business models are identified for the exploitation of PROMISE technologies on CAT products and services delivered to final customers.

- For the MOL demonstrator, monitoring systems for structural parts will benefit to both CAT organization and to final customer by enabling predictive maintenance, increasing machine selling value and leading to design optimisation.
- For the EOL demonstrator, part tracking capability and EOL diagnosis for engine components decommissioning will benefit to whole Reman business.

Business opportunities for CAT EOL & MOL application cases are described in detail in chapter 2 of deliverables DA2.2 and DA5.2.

4.2.2.1 CAT new business model related to PROMISE MOL application

New services could be delivered by monitoring health of structural parts. First benefits will be to avoid severe failure leading to high repairing costs and machine downtime. Second benefits will be to identify fatigue damage of the structures for making certified re-built machine, or for selling value knowledge.

Another great value will be machine ownership & operating (O&O) cost reduction thanks to design optimisation and ability to customize the design with the knowledge of fatigue status of the machines in the field.

All opportunities identified are listed below:

- Machine O&O cost reduction
- Productivity improvements due to weight reduction
- Affect replacement and rebuilding costs.
- Monitor time and severity of usage for rental fleets.
- Repair avoidance based upon monitoring of structural damage and warning prior to catastrophic failure.

- Productivity increase based upon removing weight from structures, which can be replaced with higher payloads
- Availability improved based upon structural monitoring of the severity of usage and avoiding catastrophic failures and the associated system downtime costs.

4.2.2.2 CAT new business model related to PROMISE EOL application

The global remanufacturing industry is a \$100 billion business today with an estimated compounded annual growth rate of 5-7%.

Caterpillar's remanufacturing process recovered more than 2.2 million end-of-life units in 2005. Of the approximately 135 million pounds (61 million kg) of material recovered, close to 70% was salvaged and reused to produce Cat Reman products.

Incomplete and/or missing information of incoming core results in increased inventory and material costs, minimal core optimization, and process inefficiencies.

Providing technology that increases the visibility of incoming core would add significant value to all Reman facilities.

Improving the velocity of core process flow, and product identification enables increased production. Additionally, improved inflow information could lead to reduced core processing times, core inventory, material costs, warranty costs, and New Parts Usage (NPU).

4.2.2.3 Architecture of value creation

Machines and services are sold to final customers with the highest expected margin.

Excepting commercial negotiation for selling price of the machines, new business opportunities within PROMISE MOL application case will lead to:

- Reduced material costs for the machine (reduced weight, increased durability)
- Reduced manufacturing processes costs
- Reduced logistics costs (inventories, transportation, storage of spare parts...)
- Increased machine reliability
- Reduced warranty costs
- Reduced maintenance costs at dealer site
- Increase volume of production (need of customer highest satisfaction thanks to an expected high re-selling value of machine, lowest operating costs...)
- Mass customization – utilization of structural health data to improve design criteria for productivity individualized to market segments demands

EOL application using PROMISE technologies will lead to increase Reman businesses with:

- Reduced new parts usage due to core visibility
- Reduced Caterpillar remanufacturing costs due to elimination of wasted energy/resources in the Reman process
- Increased visibility of production orders
- Increased number of cores to be remanufactured
- Velocity improvement with inventory, part tracking, and logistics automation

4.2.3 Corresponding market view

Following current markets with business opportunities are targeted:

- Utility machines (for design optimisation and increased machine productivity)
- Production machines (for increased machine reliability and durability)
- Engines (new and Reman markets)

Otherwise, expansion to new markets can be expected in areas of:

- New Reman businesses with potential for new salvage technologies; and indications of market expansion possibilities to industries outside Caterpillar (for example automotive)
- Certified Rebuild: use of structural health and component data to determine life left on machine for Caterpillar rebuilt product line offerings to customers previously priced out of market

4.3 CIMRU

CIMRU (Computer Integrated Manufacturing Research Unit) is located within the Manufacturing Research Centre at the National University of Ireland, Galway (NUI Galway). Founded in 1985, CIMRU has participated in a number of large European R&D projects. Based on this experience, CIMRU has developed expertise in the fields of systems modelling and simulation, innovation management, product data management, logistics including inbound logistics (Supply Chain Management) and outbound logistics (distribution), performance measurement and in more recent times reverse logistics and the modelling of End of Life (EOL) product recovery and resource sustainment systems.

4.3.1 CIMRU's business model

The academic aspects of CIMRU are directed by staff affiliated to the Dept. of Industrial Engineering at the NUI Galway. It consists of the CIM Research Group and the CIM Applications Group.

The research group is mainly engineers working on research and development activities that include solutions for Extended Enterprise Planning and Control, Knowledge and Innovation Management. The group concentrates mainly on areas such as extended product/enterprise planning and control systems, integration of these systems with the supplier chain and customer, product and process design issues and the design and analysis of the total system, including the manufacturing process. All of the research activity addresses industrial needs and industry is directly involved in most of the projects.

The applications group is a manufacturing consultancy group that offers business solutions to industry. These services include analysis, planning, development and implementation in the following areas:

- Business Information Systems including production and material planning and control systems;
- Extended Enterprise Systems Simulation;
- Computer Integrated Manufacturing.

These services also provide a channel through which research results can be disseminated to local industry. All staff members have broad industrial experience, and the group has worked with over 500 companies of all sizes since 1988.

4.3.2 Description of new business models

As an academic unit, CIMRU will not be involved in a commercial exploitation. Instead, CIMRU focus on disseminating and exploiting the results of PROMISE, which makes PROMISE known to people. CIMRU intends to exploit the PROMISE results as an academic unit in the following ways:

- **Contribute to disseminating research results**
CIMRU is contributing to disseminate and exploit the results of PROMISE, through conference presentations, journal articles and workshops to local industries. There is also considerable dissemination cross – project initiatives, both at local level and international level. The publications can help the PROMISE technology transmission widely both in the academia and the industry.
- **Support high quality research work**
CIMRU has a protracted experience in product lifecycle management, end-of-life operations, extended enterprise planning, system integration, product design, and etc. This experience is the strong supporter of the PROMISE research work.
- **Enhance PhD and Master program**
Offer PhD and Master Subjects to students in CIMRU. This is already realised with two registered PhD students and one master student whose thesis subjects are coming from PROMISE.

- **Development of educational content**

The results of PROMISE will contribute to the syllabus of the undergraduate course in the faculty of Industrial Engineering, providing students with an introduction to wireless technologies (RFID, Auto-ID, and etc.) and wireless manufacturing as represented in PROMISE by the product lifecycle and its use of PEIDs.

- **Transfer knowledge**

With the inter-team seminars and workshops, CIMRU can transfer technology among European or government-aided research programmes, e.g. PROMISE and AMI4SME. Also, CIMRU also has the opportunities to local industry through joint projects.

4.4 COGNIDATA GmbH

Cognidata GmbH is an SME consisting of a number of leading computer science experts who support industry companies in carrying out complex research and development projects. Current activities include

- the building of prototypes for fault diagnosis,
- XML message mapping, metadata harmonisation, and
- the application of RFID technology.

The customer base includes among others Altana, SAP, Microsoft, Deutsche Telekom, ALSTOM, Lufthansa Airlines and State Nordrhein-Westfalen.

4.4.1 COGNIDATA's business model

Cognidata is supporting its customers in applying leading edge technology. The support is delivered as follows:

- Project consultancy and coaching
- Implementing systems or prototypes
- Preparation of reports
- Organizing workshops

These services are carried out either with own resources or with the help of contracted external researchers. Business is generated by accepting only projects where the revenue exceeds the costs.

4.4.1.1 Technology Transfer in general

Cognidata is forced to closely collaborate with researchers in order to know business opportunities that can be realized with new technologies. In most projects Cognidata is transferring research knowledge to industrial customers.

4.4.1.2 Technology transfer related to PROMISE

The analysis of its products is very important for many manufacturers. With the development of PEIDs a new level of monitoring is possible. Cognidata will approach its current and potential new customers with the service of analysing their product lifecycle.

The offered service will consist of two parts:

- Selling a software product for which a license fee is charged and
- Installing, extending and tuning the software product for which a daily based consulting fee is charged.

During the PROMISE project phase, Cognidata will extend its knowledge und current software instruments in a way that it can be reused in many branches and applications.

4.4.2 Description of new business models

Cognidata aims at building and offering a Decision Support System (DSS) that is flexible enough to cover a variety of different applications of different branches. A DSS is usually a specific class of computerized information system that supports business and organizational decision-making activities. Our DSS will be an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. Herein, the PEID data will play a prominent role.

The information that our decision support system gathers and presents will be:

- Accessing all of the available information assets, including legacy and relational data sources, cubes, data warehouses, and data marts;

- Comparative sales figures between one week and the next
- Projected figures based on new developments and assumptions
- The consequences of different decision alternatives, given past experience in a context that is described.

4.4.2.1 Revenue model

Revenue model (year)	2.006	2.007	2.008	2.009	2.010
<u>A. Revenue in Euro</u>					
Projects	0	0	5	8	10
Licenses					
On-time payment	0	0	10.000	10.000	10.000
yearly maintenance fee	0	0	10.000	10.000	10.000
Saldo	0	0	100.000	210.000	330.000
Installation projects					
project revenue	0	0	100.000	100.000	100.000
Saldo	0	0	500.000	800.000	1.000.000
Subsequent consulting projects					
No	0	0	0	3	10
Revenue	0	0	0	25.000	25.000
Saldo	0	0	0	75.000	250.000
Revenue	0	0	600.000	1.085.000	1.580.000
<u>B. Cost/Investment in Euro</u>					
Internal staff					
No	2	2	2	3	6
Cost (per person)	75.000	78.750	82.688	86.822	91.163
Overhead (altogether)	25.000	37.500	56.250	84.375	126.563
Saldo	175.000	195.000	221.625	344.841	673.540
External staff					
No			4	10	10
Cost (per person)			50.000	50.000	50.000
Saldo			200.000	500.000	500.000
Cost	175.000	195.000	421.625	844.841	1.173.540
Profit/Loss	-175.000	-195.000	178.375	240.159	406.460

4.4.3 Corresponding market view

The market consists of all manufacturers of industrial goods.

- Power plants;
- Turbines;
- Ships;
- Elevators;
- Cars;
- Heating equipment;
- Airplanes;

Only in Germany Cognidata assumes that the market consists of hundreds of companies.

4.5 FIAT GROUP

4.5.1 CRF

CRF is the Research Centre of the FIAT Group and acts as a Research Department for the FIAT Group Sectors: Fiat Auto (including FIAT, Alfa-Romeo, Lancia, Ferrari, Maserati...), Case-New Holland (CNH), IVECO, Comau and other companies (Business Solutions,...). As a private Research Centre funded exclusively by private funds (with the exception of European Projects) CRF is dependant on contracts with the Sectors and works exclusively on joint research projects with them, or with external companies, which represented roughly 15% of the budget in 2005.

With respect to European or Italian-subsidised Research Projects, it is thus crucial for CRF to 1) investigate areas where the Sectors have expressed their interest for investigation, 2) develop collaboration with the Sectors in the framework of joint projects, 3) achieve technically sound and feasible solutions corresponding to the requirements expressed by the Sectors, 4) demonstrate the economic or strategic interest for the Sectors in taking-up and implementing the results of the Projects in a real industrial context, within a timeframe inferior to 2 years. In this respect it is not surprising that some of the PROMISE methodologies have already been transferred in the framework of A4 to IVECO (at PROMISE month 12).

4.5.2 IVECO

With sales exceeding Euro 9 billion, 31,000 employees and approximately 800 dealers all over the world, Iveco (Industrial Vehicles Corporation) is now one of the world's largest manufacturers in the transport sector.

The group operates through the following brands: Iveco, Iveco Motors, Iveco Magirus, Astra, Seddon Atkinson and Irisbus.

The company designs, builds and markets:

- a comprehensive range of light (2.8 – 6 tonnes GVW), medium (6 – 16 tonnes GVW) and heavy (over 16 tonnes GVW) commercial vehicles for use on and off the road
- engines for vehicle and industrial applications
- passenger transport vehicles
- special vehicles
- fire fighting vehicles

Iveco also complements its product range with an array of after-sales, financial and used vehicles services, in particular customised maintenance contracts. Iveco also provides regenerated parts, which are guaranteed the same quality standards as original parts.

In the Annex, the reader will find the complete business model for the IVECO demonstrator (A4).

4.6 ENOTRAC AG

ENOTRAC is an independent engineering consultancy for railway vehicle and infrastructure technology. An open-minded, dedicated, and professionally-qualified team of engineers solves practical, theoretical, conceptual and, in particular, interdisciplinary tasks in the areas of:

- **Vehicle Technology:** Engineering for modifications and new construction, specification, call for tenders and evaluation, development of software and equipment, energy studies, analysis and solutions of technical problems.
- **Safety, RAMS (Reliability, Availability, Maintainability and safety):** Proof of safety, reliability studies, RAMS-engineering, ETCS (European Train Control System)-engineering and tests, EMC-investigation (safety installations - vehicles - traction power supply - return current), measurements.
- **Traction Power Supply:** Concept and dimensioning, simulations with FABEL, ZNET, SIMNET (Programs for the simulation of the characteristics of Electrical Power Distribution Networks) and EMFCALC (Electromotive Force Calculation), power supply studies, earthing concepts, return current arrangements and stray current protection, protection concepts, ONIR (Ordinance relating to Protection from Non-Ionising Radiation)-tests (magnetic fields) and measurements.
- **Organisation and Processes:** Asset, Configuration and Maintenance Management for vehicles and infrastructure, software-solutions and LCC-engineering, diagnostic tools, organisation of workshops and maintenance processes.

Enotrac's services are directed especially towards railway companies, public transport authorities, other public authorities, and the traction and railway equipment suppliers in Europe and overseas. In addition to our professional know-how and extensive experience, we also offer our customers' a multi language capability in English, German, French, Spanish, Arabic and Italian.

4.6.1 ENOTRAC's business model

Working in a very specialised field within a highly regulated environment which contains a confined and practically stable number of potential customers means that business development cannot economically be undertaken with a "consumer product" type of advertising and marketing approach.

ENOTRAC AG, and similar engineering consultancies within the rail industry, are however very visible within the small group of their potential customers and is therefore easily measured by the quality and effectiveness of the results obtained through the use of the services we have provided.

Significant New Business Development in this situation inevitably leads to diversification into non rail related markets, which in turn bears the risk of loss of specialised competence. This can quickly lead to the emigration of otherwise faithful clients within the area of original core competence.

The ENOTRAC AG philosophy is to maintain the significant regular client base which the company has built up over a period of some 15 years and only to venture into peripheral activities where these can easily be accomplished using the company's core skills and with no risk to the further development of these skills.

However, to maintain the significant regular client base the ENOTRAC AG staff competency must be continually developed in line with changing technologies relevant to the rail sector and its economies. The participation in the PROMISE Project is significant in this respect, as life cycle data management is an essential prerequisite to maintaining safety relevant systems throughout there life time.

We are of the opinion that our Business Model cannot be satisfactorily represented in Drawings and Graphs! We believe that our modest yet continuous expansion over a period of some 12 years confirms this approach.

Core Competencies

- Analysis and solution of interdisciplinary engineering and process tasks in the rail operation, manufacturing and supply industry in particular for safety relevant applications of equipment, hard- and software.
- Development and adaptation of control and monitoring systems, including bespoke software solutions, for rolling stock and infrastructure of guided transport systems.
- Independent Safety Assessment of equipment, systems and processes for the issue of initial or subsequent Operational Authority for rail and guided transport systems.

Established markets - to be retained

- Rail Infrastructure Owners and Operators;
- Rail Vehicle Owners and Operators;
- Rail Manufacturing Industry;
- Regulatory Authorities with responsibility for the rail industry.

Potential peripheral markets - for careful consideration

- Electrical Generation and Distribution;
- Road Based Public Transport Undertakings;
- Specialised Plant and Equipment with Safety Relevant Characteristics.

4.6.2 Description of new business models

Enotrac identified the following relevances of PROMISE products and solutions:

- Simplify key component identification.
- Provide more efficient methods of Field Data Collection. Thus providing a more reliable data base for operational and safety risk assessment.
- Provision of a more efficient and reliable analysis of Field Data by provision of PDKM and DSS support processes.
- Enable more appropriate application of Operational Regulation to Safety Relevant Systems through the improved risk assessment possibilities which should result from the above points.
- Contribute to increased application of Condition Based Maintenance for safety relevant systems.

The ENOTRAC AG approach is to bring the benefits of the PROMISE products and processes to our clients in the rail industry to enable them to provide safe and environmentally acceptable transport services to their customers.

4.6.2.1 Architecture of value creation

The value return for ENOTRAC AG is the improved assurance of maintaining the existing client base in the face of increasing, low cost, competition from consultancies in developing regions.

4.6.3 Corresponding market view

The Rail Transport Industry, despite its low environmental impact and significant energy efficiency, is economically disadvantaged, both in Europe and abroad, by both the relatively high investment required to make even small changes to the infrastructure and the public expectation of quick results in a world dominated by accelerating rates of change.

Therefore, to successfully provide a continually improving service in both the passenger and freight sectors it is essential that the industry actively participates in the development of new technologies and is at the forefront of the adoption of those that can be shown to bring improved operational flexibility and efficiency whilst maintaining safety and environmental acceptance.

4.7 EPFL

The Swiss Federal Institute of Technology, located in Lausanne, is one of the two Swiss Institutes of Technology, educating more than 4000 students in all engineering disciplines.

4.7.1 Identification of exploitation opportunities

The LICP lab of EPFL, as an Academic unit, intends to exploit the PROMISE results in the following ways:

- **Development of educational content**

Use the PROMISE results to develop courses and content for education of students on PLM in engineering disciplines at the PhD level. This is already realised with a course on PLM offered to the students of the Doctoral Programs of EPFL. This course includes concepts on closed-loop PLM developed in PROMISE.

- **Enhance PhD and Master program**

- Offer PhD subjects to PhD students at EPFL. This is already realised with two registered PhD students whose thesis subjects are coming from PROMISE.
- Offer Master thesis projects based on PROMISE to Master level students of EPFL. This is already realised with five master thesis already realised by EPFL students in collaboration with CRF, CAT, BT and ENOTRAC.

- **Initiation of further research projects**

Create spin-off research projects based on ideas initiated and generated in PROMISE. This is already realised with one research proposal submitted at the Swiss National Foundation. Also, some ideas are under developed for proposals to be submitted for Swiss National funding and under the FP7 program.

- **Contributions to standardization**

EPFL has already initiated the promotion of standards on closed-loop PLM concepts within the PLCS community of ISO TC184 SC4. The first presentation in that direction is planned for the 28th June 2006 at the general meeting of ISO TC184 SC4 in Toulouse. EPFL has the intention to continue supporting the development of such standardisation activities in that direction.

- **Spin-off opportunities**

By the end of the project the PROMISE team of EPFL, together and with the support of the Industrial Relations Services of EPFL, will explore opportunities and possibilities to create a company with the scope to exploit its developed know-how on closed-loop PLM.

4.8 FIDIA

FIDIA is a world leader in the design, construction and marketing of integrated systems for the machining of complex forms for the moulds and dies industry. Identification of new business models

4.8.1 Identification of new business models

FIDIA expects to reach the following goals as a result of PROMISE project:

- Improvement of machine performances
- Innovation in maintenance strategy in machine tools field
- Breakthrough respect the other competitors

4.8.1.1 Value proposition

FIDIA expects that the new business opportunities will create benefits for its customers as follows:

- Reduction of service costs and fares
- Decrease of loss production costs

4.9 Helsinki University of Technology

Helsinki University of Technology (HUT) was founded in 1849 and received university status in 1908. It has twelve faculties, nine separate institutes, 19 degree programmes, 250 professors, 15 000 under- and postgraduate students, 961 Masters' degrees awarded and 130 doctorates (2004). Research and teaching are the basic tasks of HUT. HUT conducts scientific research and provides related teaching. The technical, educational, and social significance of Helsinki University of Technology lies with research and teaching, in producing and transmitting scientific knowledge – a central issue in building for the future.

The University receives most of its funding from the national budget through the Ministry of Education. The rest comes from various sources, mainly as acquired funding for research and services.

In 2004 total funding from state and other sources was 223 million euros. 48% of the University's funding came directly from the national budget for operating costs and 52% was acquired from various other sources.

1000 euro	1999	2000	2001	2002	2003	2004
Total financing (KOTA)	161,897	177,075	184,434	191,648	193,997	205,660
from the national budget	90,083	97,649	101,248	107,575	110,145	114,363
external financing	71,814	79,426	83,185	84,073	83,852	91,297
external financing / total expenditure	0.44	0.45	0.45	0.44	0.43	0.44

4.9.1 HUT-BIT Research Centre business model

Most of the research conducted in PROMISE by HUT is performed in the BIT research Centre. Business, Innovation and Technology (BIT) are the key words to describe research activities that improve the competitiveness of companies and organisations. BIT Research Centre, former TAI Research Centre, has over fifteen years' experience of R&D projects in which human activities combine with information and manufacturing technologies. This multi-disciplinary approach benefits all parties concerned, in business, academia and public services.

In order to make organisational, process or technological innovations a major financial success, there is a need to gain better understanding of complex development environments from the viewpoint of product development, production and commercialisation. Also, BIT Research Centre is a unique platform to integrate research and teaching activities.

BIT Research Centre is one of the nine independent (campus wide) institutes of the Helsinki University of Technology. It has a staff of about 130; 80 researchers (master level and up) including close to 20 post-doc research fellows. The annual research budget is € 6.5 million (year 2004). BIT research areas cross chair and department (faculty) boundaries in order to enable a close co-operation with trade and industry as well as public organisations and policy makers. The main research focus areas are Trade and Services, ICT Industry, Healthcare, Real Estate and Construction, Manufacturing Industry and Public Organisations/Policy Makers.

National and international projects are carried out in collaboration with companies, and often in the framework of research programs. The international cooperation has grown remarkable during the past years. BIT has enabled several Finnish companies to start international R&D cooperation in Europe and to an increasing degree with partners globally outside EU.

BIT's financing mainly comes from research projects financed by the Finnish Technology Agency (Tekes) and by industrial partners. The Academy of Finland and the EU are also important financers of BIT.

4.9.2 Description of new business models

For its particular nature of Research Centre, HUT-BIT will not be involved in a commercial exploitation. HUT-BIT has a good base in disseminating and exploiting the results of PROMISE thanks to its key-role in the Finnish and European research context. For these reasons HUT-BIT can contribute to spread the project results through conference presentations, journal articles and exhibitions.

Several spin-off companies have also been the result of BIT research projects, as well as new business opportunities for collaborating companies in various research projects. Due to the close relationship with industry in PROMISE, PROMISE should provide a good context for developing this kind of business models.

4.9.2.1 Value proposition and architecture of value creation

Because HUT-BIT is a non-profit organisation, the main value proposition and comes from augmenting the know-how and competitiveness of European companies in the global market. Dissemination of results in various forums can be considered to be a part of this activity because it should raise the appreciation of European research and industry.

4.9.2.2 Revenue model

The revenues of HUT-BIT are mainly based on external financing. Therefore it is essential that HUT-BIT is capable of delivering research results of sufficient quality and importance to all research partners, i.e. national and international organisations for funding research but also (and in particular) company partners.

4.10 INDYON GmbH

Indyon GmbH provides innovative electronics solutions benefiting customers by offering comprehensive know-how. Founded in 2002 the company is active in the areas of Product Tracking and Communications. Indyon supports customers from consulting to system servicing. In many cases solutions are created in joint venture with partners. The Indyon team holds extensive know-how in software development and electronic systems.

4.10.1 INDYON's business model

Indyon offers its customers tailored development and implementation of electronic components and software, focusing on RFID and telecommunication solutions. Its core competencies embrace:

- Software- and hardware engineering
- RFID Systems Know-How
- New innovative industry solutions for the new wave of Supply Chain Management

Predominately, INDYON targets the logistics sector (food, paper, wood,...) as well as the Manufacturing Industry.

INDYON provides its customers with the following products:

- Track+Trace RFID positioning system
- Info terminal for rough environment

As an example Track+Race is an RFID driven Real Time Locating System (RTLS) combining pallet identification and location. Track+Race is simple to integrate into existing warehouse and IT environments. Benefits for customers are total visibility of forklift truck operation, goods location and increased productivity / reduced error rate. Cost of ownership is low due to limited investment and minimal maintenance cost.

4.10.2 Description of new business models

INDYON has identified the following business opportunities:

- Business Model 1: Technology and System Supplier
- Business Model 2: Services

They are described in the following:

Business model 1 -Technology and System Supplier

For Indyon as a development company for software and hardware solutions the obvious PROMISE business is the development of hard- and software components.

Product focus:

- Development of software and/or hardware components that are focussed on Supply Chain issues like batch tracing, Supply Chain Security, etc. These (software) systems provide integrated PROMISE functionalities and can handle the additional data generated through PROMISE concepts. In addition, they display the required interfaces to other systems (e.g. PPS, WMS, PLM).

Software focus:

- Device controller
- Middleware

Hardware focus:

- Customer and solution specific RFID readers
- Customer and solution specific RFID antennas

Target markets:

- Manufacturing companies, production and warehousing sites
- Logistics companies, warehousing sites

Business model 2 – Services

Apart from PROMISE products in the sense of software and hardware, we see consulting and services as a business that can increase with growing acceptance of the PROMISE concepts in the industry.

Service Offerings:

- Consulting companies that need education for the implementation of PROMISE concepts and products.
- Planning and organizing the supply chains and the respective information flows.
- Consulting companies that need education in Supply Chain Security issues.
- Systems integration of PROMISE solutions.

Target markets:

- Producing companies, production and warehousing sites
- Logistics companies, warehouses

4.10.2.1 Value proposition

Our exploitation approach focuses on companies where the products submitted to the PROMISE models are part of a (global) value chain. In this respect the information flow across company boundaries is the key.

General Aspects

Logistic processes are a subset of PLM where identities and other PLM relevant information have to be kept connected to the product during its life phases. This connection can consist of a PEID, a barcode, paper based information or other information storage devices.

Moving a product from A to B that is the information has to move with the product or the information (if on a central database) has to be updated with the new address of the product.

There are many logistics related operations in the life cycle of products that are PLM relevant. Apart from product movements also operations like mixing of products have to be recorded.

As an example shown in the Demonstrator A3 (EOL information management), where plastic parts are being milled, mixed and depending on their quality reused or disposed, a closed information flow is key to PLM when it comes to decision making.

These processes are also closely related to batch tracing being mandatory in many industries like the food industry where all ingredients have to be traceable and that is relating the individual characteristics (of the ingredients) to the specific product in order to keep the information flow unbroken.

Driving Forces

Liability issues and regulations (apart from predictive maintenance etc.) facilitate systems that help to trace products or batches and that is valid for many industries that have to deal with these issues like the food and automotive industry. These requirements fit to the idea of PLM where (from the logistics point of view) the information flow has to be continuous and complete as well. Most of the mentioned issues are directed to lift the level of Supply Chain security. Examples for regulations are:

- Batch Tracing of food (EU regulation 178) – in force since 1.1.2005.
- Bioterrorism Act of FDA (Food and Drug Administration): Security of food chains into the USA – in force since 12.12.2003.

- Customs – Trade Partnership Against Terrorism (C-TPAT): Security of container imports into the USA – in force.
- US Homeland Security regulations: they affect all issues of imports to the USA and national security issues.
- Third party Liabilities: Increasing liability risk towards third parties in the USA, Europe and Asia.

However, this is just the beginning of a set of planned requirements and regulations, which influence the Security of the global supply chains. They lift the absolute responsibility of the security to the involved companies and other stakeholders.

4.10.2.2 Architecture of value creation

Using systems that help the customer to fulfil the regulations or establish a higher level of Supply Chain Security is one approach. These issues or soft factors are difficult to measure in terms of “financial benefit” for the customer; the range can be very wide. A company that has to do a public back order can extremely suffer from additional costs in the range of millions for a widespread product (e.g. food), plus the negative effect on the image and future sales.

The other benefits are measurable in the sense that the savings are compared to the existing infrastructure. Since this product tracking systems apply to many different industries the business case has to be evaluated for each application/industry.

The following list of benefits for the customer is divided into general benefits and benefits that apply mainly to companies that recycle products. General benefits embrace:

- Fulfilling regulations (e.g. EU regulation 178)
- Full control over liability issues (full visibility of all material flows)
- Reducing the risk of additional transport costs (e.g. delays when importing into the USA)
- Reducing the risk of public back orders (Cost of back order and image loss)
- Reducing cost related to product and/or batch tracing (Through optimisation of the supply chain)
- Reducing the cost of product development using PLM data (Using MOL- and EOL- data the BOL process can be optimised)
- Speeding up processes in the supply chain due to the enhanced information flow and better data/information (Reduced cost for Supply Chain Management)
- Specific benefits for companies that recycle products:
 - Reducing the cost of recycling (less cost related to the acquisition of data related to material to be recycled, less machine costs (e.g. due to pollution of machines))
 - Enhancing the quality of recycled material (through more and better data of the goods to be recycled)
 - Enhancing the recycling rate (through more and better data of the goods to be recycled)
 - Additional data for product design with recycled material (statistics) using more and better data.

4.10.2.3 Revenue model

Since the described business models apply to a very broad range of companies and industries the calculation of potential revenues is difficult and has to be calculated for each specific application. In general there are four income tiers of revenue that have to be taken into account:

1. Hardware: RFID readers and antennas, RFID devices, application specific electronic hardware components.
2. Software: device controller, middleware regarding RFID applications for PROMISE solutions.
3. Services: consulting and implementation of PROMISE concepts and solutions.
4. Maintenance for installed systems.

All these revenues resulting from the newly defined business models can be seen as a well fitting contribution to the existing business model from Indyon.

4.10.3 Corresponding market view

New regulatory compliance requirements as mentioned in section 3.2.4 are forcing end users to make extensive changes across all of their business practices. Depending on the appropriate regulatory directive those requirements principally address each industry, especially the food, automotive, goods, or the aviation industry.

An AMR research from February 2006 about compliance spending (to fulfil legal regulations) is providing valuable data for a rough estimate of the addressable market for PROMISE solutions:

- For 2006, AMR Research predicts that companies will spend a total of \$27.3B on all aspects of compliance, of which \$8.8B will be put toward technology support. Spending will approach \$28B in 2007, with technology-related expenditures exceeding \$9.1B. Total numbers are broken out into three major categories: head count, external services and consulting, and technology. Any expectation that compliance spending might moderate is just wishful thinking as companies in all industries grapple with increased regulatory concerns and stricter governance and risk policies within their own firms.

These spending estimates were generated from a survey, conducted in 4Q05, of more than 325 North American business leaders and IT professionals. Spending by category is defined for 2006 and 2007.

Most of the companies display a head count of more than 10,000, but compliance applies to all companies participating in the global supply chain.

- Nearly 75% of firms we surveyed indicated that they would use investments for compliance to support other business activities. This is consistent with the surveys of previous years, but the specific processes where they expect benefits are somewhat different. This year, streamlining of business processes is top of mind, while last year companies noted they expected better reporting and analysis to result from compliance investments.

As mentioned before the compliance issues are very much in line with the PROMISE concepts and the displayed data are a good estimate for the market some of the PROMISE products and solutions are designed for.

4.10.4 References

- AMR Research: Compliance Tech Spending To Top \$8.8B, February 16, 2006

4.11 INFINEON Technologies AG

Infineon Technologies AG offers semiconductor and system solutions for automotive, industrial and multimarket sectors, for applications in communication, as well as memory products. With a global presence, Infineon operates through its subsidiaries in the US from San Jose, California, in the Asia-Pacific region from Singapore and in Japan from Tokyo.

Automotive, Industrial and Multimarket Business Unit

Chips are used to control a wide variety of automotive functions ranging from motor and transmission management to air-conditioning and through to ABS and airbag operation. As a result of many years of experience in the automotive field, Infineon has acquired a very high standard of application know-how and, as Europe's largest manufacturer and second largest in the world*, it offers a comprehensive product portfolio of sensors, microcontrollers, power ICs, transceivers, wireless chipsets and plastic optical fibres. These products cover the three major areas of automotive application: the drive train, safety, and car-body and comfort electronics. In the manufacture of such parts the overriding precept is 'zero failures' – absolute flawlessness in more than one billion components supplied every year.

4.11.1 Infineon's business model

Within PROMISE, Infineon serves as technology provider for so-called Product Embedded Information Devices (PEIDs). The PEIDs are identification, data collection and storage systems that are (at least partially) attached to products for product lifecycle monitoring and management (PLM).

Infineon as semiconductor manufacturer is currently already offering products that allow writing, storing and reading chunks of information on small, cheap electronic components, so-called Radio-Frequency Identification Devices (RFID). These components are battery-less, for which they are also called passive. These contactless memory products are being used everyday by millions of people within electronic tickets and access control systems, as loyalty cards and within brand protection schemes. Infineon's RFID products are used to efficiently and securely trace and manage products and assets globally. All products in Infineon's product range are compliant to globally agreed standards and frequencies. The range comprises of proven MIFARE® technology, my-d vicinity (ISO15693/ISO18000-3), my-d light (ISO15693/ISO18000-3), my-d proximity (ISO14443) and my-d pjm (ISO18000-3 mode 2). Further, some of these devices exhibit valuable security features like a strong 64 bit crypto algorithm for copy protection, secured data access and e-purse applications. Passive RFIDs are closed systems; they are highly integrated and come as single-chip bare-die components mounted on a cheap plastic inlay. This makes passive tags unrivalled in price.

In order to extend its tag product portfolio, and thereby to extend the addressed market both horizontally and vertically, Infineon is also considering active radio-frequency technologies for applications like product monitoring, maintenance, or short-range item tracking. These active systems are, in contrast to passive systems depicted above, battery-powered and equipped with a small microcontroller, so that they are in particular capable of reading sensors (temperature, light, or more sophisticated parameters such as vibration). Thus, active tags ideally fit many of the application cases that are considered in PROMISE.

Compared to passive tags, active tags are more flexible since they are PCB-mounted and contain a microcontroller with standard interfaces that allows adapting the size of the memory, the sensor interfaces, or the functional behaviour of the system as required by the application. Further, due to the availability of power, active tag systems usually offer a better RF link quality than passive RFID based systems. This feature makes active tags more suitable for harsh environmental conditions or conditions that are less manageable.

Infineon is also playing a key role in the expanding wireless world by actively driving and supporting the market trend with sophisticated semiconductor-based solutions. In the segment of cost-optimized, short range wireless solutions, Infineon is a leading supplier of wireless control systems operating in the free 433MHz/868MHz/915MHz band. Wireless control has become an indispensable item of everyday's life. Starting from routines like gate openers, window shutters through metering and wireless fire-alarms to automotive applications like remote keyless entry and tire pressure monitoring systems wireless control devices have established themselves as a cost-efficient and robust solution for a broad range of control applications. These and related technologies will serve as the basis for the development of PROMISE compliant active tag systems.

4.11.2 Description of new business models

Although the applications for passive and active tags are closely related, the addressed markets for passive and active tags are rather distinct.

- Firstly, while passive tags are highly standardized, closed systems, active systems are most likely open, extensible systems that are less standardized and thus less cost sensitive. This means that the active tag product must be designed with a potentially sufficiently broad diversity of applications in mind, and cover the optimum portion of the value chain in order to minimize business and technical risk and to maximize business opportunity.
- Secondly, nevertheless quantities in pieces are expected to be much smaller for active tags than these seen for passive RFIDs today. However, the active tags offer higher complexity and thus provide an increased vertical presence in the value chain towards system-ready solutions, leading to higher price per piece, and potentially higher margin. Thus, the total accessible market is significant if the tag product is designed flexible enough to meet diverse application requirements at an acceptable price level and if the vertical participation in the value chain is.
- Thirdly, from the statements above follows that directly addressing the end customer market is mandatory in order to meet the application requirements in terms of time-to-market, functionality, customer binding, and cost. Also in this respect, the demands in marketing differ for active and passive tags. Although Infineon is on the one hand successfully collaborating with passive RFID reader manufacturers, it on the other hand does not participate in their design, manufacturing or sales. Infineon thus holds indirect access to the end customer market through system integrators, consultants and distributors, focusing on the RFID tag hardware rather than on the system solution. This situation is entirely different from the active tag market, which requires system solutions on tag level due to the absence of the reader device.

Thus, PROMISE offers an excellent opportunity to investigate typical end user scenarios, gather requirements from system integrators, and define common interfaces with technology peers (i.e. to the middleware). For active tags, the challenge is to integrate small, low-power and low-cost embedded systems into IT infrastructure systems. This challenge has traditionally been on the side of the RFID reader providers, which do not appear in the value chain for active tags. Their portion of the value chain must be addressed by the active tag provider by in-house development or external partners.

4.11.2.1 Value proposition

The key innovation within PROMISE in respect of bridging the gap between active tags and IT systems is to grant access to the active tags by utilizing a service-oriented architecture (SOA). As a software architectural concept, a SOA defines the use of services to provide the software functionality. A network node, i.e. the active tag, makes resources available to other participants in the network by replying a service response to a service request. The services are stateless and therefore independent, and thus provide an appealing programming model even for embedded devices because of functional seclusiveness and simplicity. Even small functional units can be declared as services and can be freely used by every other network participant, even from a remote location, because their interfaces are public. Using this modularity makes sure flexibility and the support of distributed components is maximized.

In the SOA arena for ad-hoc device interoperation, a number of standards have emerged, most of which have meanwhile disappeared or converged to two main candidates, which are Web Services (or, more specifically, DPWS), and Universal Plug and Play. In particular, Universal Plug and Play has gained strong momentum through the current hype in the home entertainment segment. DPWS and UPnP are technologically closely related, so that migration from one standard to the other (or implementing both) is associated with relatively low technical effort and risk. In summary, the status in standardization is considered as mature enough to support market entry of SOA based embedded products to early technology adopters.

Although technologically challenging, bringing a UPnP-based SOA down to embedded systems thus constitutes a significant value for Infineon's potential active tag products. For both system integrators and end customers, SOA fosters the simple integration of active tag systems into the IT middleware and backend by a pragmatically simple programming model for distributed systems. This advantage is eventually to the benefit primarily to the end user and thereby offers a competitive advantage for Infineon's SOA based active tag system.

SOA based active tags offer a high-level, standardized interface, resulting in a strong participation of Infineon in the entire value chain. This by itself is another value earned through PROMISE and its involvement of system integrators and potential end customers. As explained above, the understanding of end customers' demands and requirements are a prerequisite for designing an active tag product that meets market expectations in terms of functionality, price and time-to-market.

4.11.2.2 Architecture of value creation

In the awareness of the strong growth potential of the active tag segment, Infineon is developing a SOA-based embedded system with short-range wireless connectivity. This so-called Sindrion system is a PCB-level integrated rapid prototyping system that allows the realization of e.g. UPnP compliant, distributed embedded systems, and to study these systems in real application cases.

Within PROMISE, the Sindrion system will be streamlined to the requirements imposed by the PROMISE architecture, its interfaces and the applications provided by the PROMISE consortium. As a first step of exploitation the efforts of PROMISE, Infineon's Automotive, Industrial and Control business unit plans to commercialize the corresponding hardware by during the following year. Thus it will be available to PROMISE partners through the regular distribution channels early during the course of the PROMISE project.

During the course of the PROMISE project, other components related to the active tag system (e.g. the SOA-compliant firmware and software, or development tools) will be developed and made available to the partners. Commercialization is planned later during the PROMISE project, when sufficient maturity of the technology and enough confidence in the validity of business perspective of the PROMISE technology has been gained.

4.11.2.3 Revenue model

Although for the active tag system flexibility is more important than price, a path towards cost reduction is the next crucial step in the process of market entrance of the SOA based active tag systems. For the evaluation kit that will be made available in the first step, cost is not of prime importance, but its value is in the functional definition of the active tag system. Effective cost reduction is only achieved by a higher integration of components. This requires the development of system-in-package or system-on-chip solutions, which are out of the scope of PROMISE due to the project's focus and availability of resources.

The knowledge gained during the development of the active tag prototype system within PROMISE relates to system and hardware architecture design, firmware, software and tools design, as well as application understanding. It serves as the basis to build cost-effective, SOA based active tags that easily integrate into IT middleware and backend systems and open an

entirely new market, out of which the PLM active tag market represents a certain fraction. The evaluation kit being developed within PROMISE is not directed towards a cost-effective, large-scale-market ready solution, but is understood as a tool to gain the desired knowledge described above. The commercialization of the corresponding evaluation kit documents Infineon's sincerity in the exploitation of the results achieved in PROMISE.

4.12 InMediasP

InMediasP's main business focuses on optimisation of innovation and product development processes as well as on application of advanced information technologies. InMediasP is active in the design and implementation of distributed processes for global engineering, virtual enterprises and supplier integration. The consulting services and software technologies of InMediasP restructure and improve engineering processes using modern IT capabilities. Individual IT solutions and consulting services cover the customisation, extension and integration of IT systems such as CAD, Digital Mock-Up, PDM or ERP interfacing. Concepts and applications for Product Lifecycle Management is one of InMediasP's main areas of activity.

Above and beyond this InMediasP offers the design and implementation of customer specific internet-/intranet as well as data base solutions for company wide distribution of information. Web access and telecommunication is supported by the application of innovative user interface technologies based on JAVA. For fast development of application systems CORBA compliant platforms are provided which allow easy integration of third party system components.

Consulting services and contracted IT solutions of InMediasP are independent from any IT vendor, specific adapted to the customers' needs and its product range. The services include the entire from analysis, concept to realisation. Analysis of engineering processes are followed and accompanied by concept development and deployment. In this role staff of InMediasP is managing and guiding industrial project teams, also of third party companies.

Within this thematic scope InMediasP offers business operations that can be assigned to the three main areas

- Consultancy Products,
- Software Development and
- IT Services and Training.

A more detailed portfolio of InMediasP's services is shown in the figure below. The services include also software development and system integration.

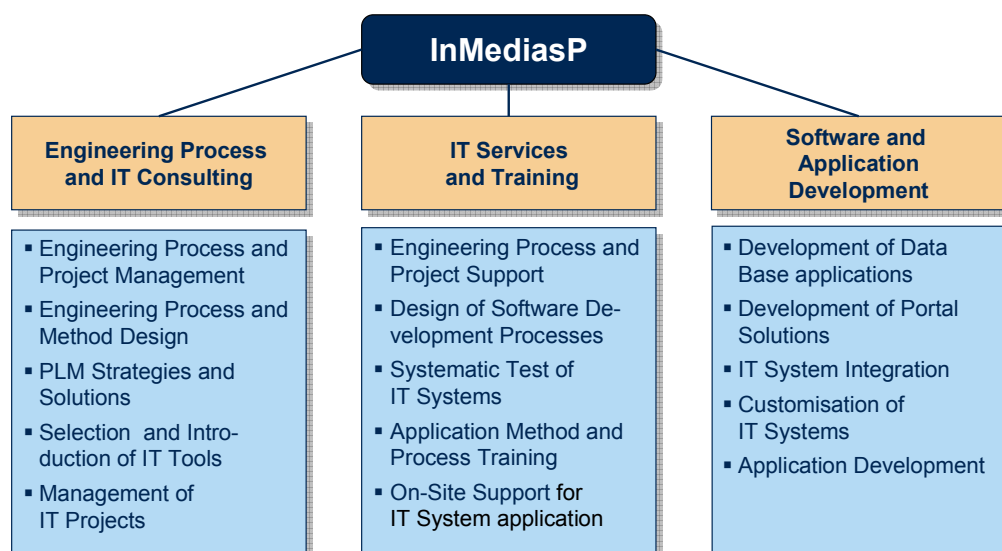


Figure 3: Portfolio of InMediasP's services

4.12.1 InMediasP's business model

InMediasP's business model bases on the development and selling of consultancy products, software solutions and IT services. Therefore a continuous improvement of these products has to be ensured by both, assessing and adopting new and innovative technologies and adapting the products in order to meet the customer requirements. The identification of these influences on time and the derivation of the right actions to improve the service offerings are crucial for the competitiveness of InMediasP.

To ensure that the portfolio of InMediasP stays marketable is not only dependent on the best possible definition of its products but also on successful performed customer projects. Therefore it is inevitable to qualify the staff in performing the offered services as well as in project management skills. All services that are provided by InMediasP are designed to be carried out in projects, mainly at customer's site, and thereby bring results that can be considered as individual, customer-specific solutions.

For both aspects mentioned above, the continuous alignment of the services and the education of staff, the participation in research projects is a useful support. On one hand the assessment of new technologies can be carried out in those projects, on the other hand younger consultants and software developers can be trained in various skills within research projects.

Along with the continuous improvement and alignment of the offerings the sales processes have to be well defined and performed. Since all of the services provided by InMediasP are very technology-oriented, a close cooperation of technical staff and sales/marketing staff is necessary. Furthermore is an efficiently working project management in all performed projects inevitable. Therefore proven methods have been developed and documented that will be applied generally. The current business model of InMediasP is shown below.

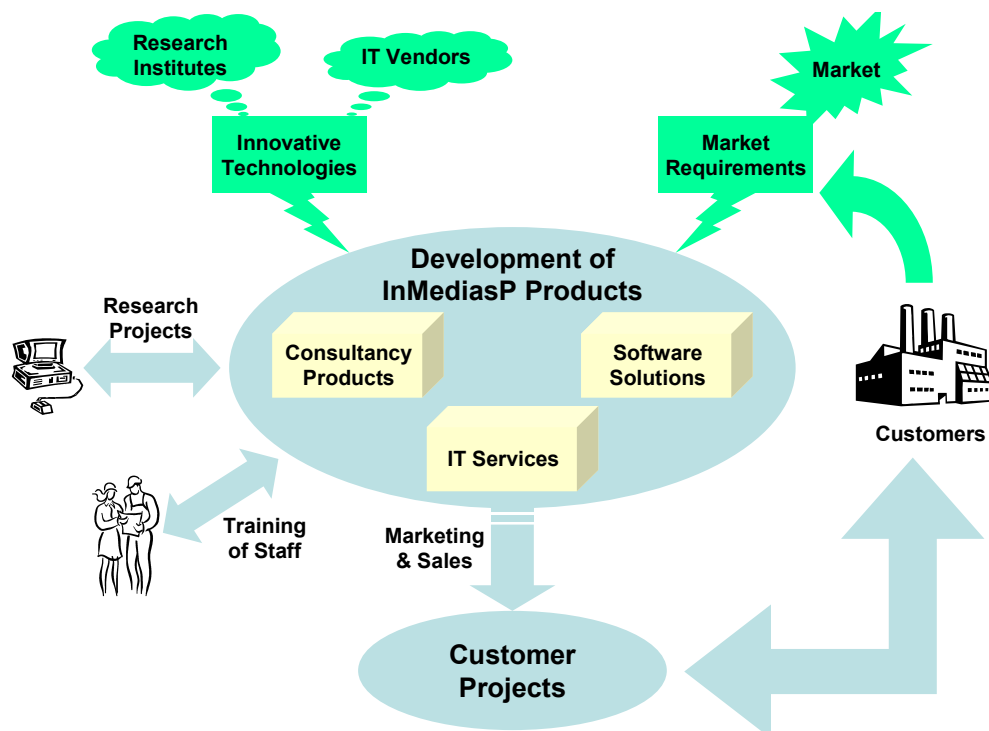


Figure 4: InMediasP's business model

4.12.2 Description of new business models

For InMediasP the business opportunities based on the PROMISE results can be both, actually new businesses as well as major business improvements in areas where currently business is carried out.

The consultancy products play the major role within the scope of InMediasP's business opportunities. However, the targeted integration solutions will also contribute to further business in terms of combined consultancy/IT products. Hereby integration concepts will be compiled for customers and the implementation will base on the demonstrators developed in PROMISE.

In the following subsections the areas of new business opportunities are described briefly.

- **Management of Product Configurations based on Lifecycle Model Integration**

One of the main goals of PROMISE is to close the loop of information from the product lifecycle phase usage and dismantling back to the engineering. Of course this also offers a large variety of new business opportunities for all PROMISE partners.

Especially in the area of product development, where even currently InMediasP's main business focuses on, is a large potential of new business. Today, product development is more or less a straight forward activity within the entire product lifecycle. This means that a feedback of information that can be captured during later phases in order to improve the design only happens by chance. A systematic approach with dedicated methods and tools does not exist so far. The main new businesses for InMediasP that can be derived from PROMISE in this area are:

- Consultancy for establishing a 'Closed-Loop-Engineering' in order to design optimised products based on experiences from field data
- Concepts for field data capturing
- Solutions for 'Design for X' support
- Concepts for optimised maintenance planning and execution

Within these business opportunities the generation of product knowledge by analysing and processing field data plays a major role. However, today neither this knowledge is derived properly from field data nor can it be managed sufficiently in order to improve product development, product maintenance or product recycling. With the results of PROMISE methods for generation and management of field data based product knowledge will be available.

This will lead to new business due to that companies use different (and differently customised) product data management tools. The enhancement of PLM systems to ensure product knowledge management is the main aspect in this area beside the development of new processes (see also subsection 4.8.22).

Value proposition

The main business opportunities in this area are very closely related to InMediasP's major business at all. The existing consultancy and IT services will be enlarged and completed in terms of lifecycle integration. The services include mainly the design of

- Processes,
- Analysis methods, and
- IT concepts.

The benefits for InMediasP's customers are manifold. Basically the optimised processes will lead to more efficient operations which are basis for cost reduction. But there are many more aspects. Due to fact that in the BOL phase information from MOL and BOL phases will be available and thereby can be used for specific analyses, the design of new products can be improved significantly.

With the more completed service portfolio in the area of product development InMediasP's position in the market can be strengthened and broadened.

Architecture of value creation

Due to the fact that the new services created on the basis of the PROMISE results are a complement to InMediasP's existing service offerings, in a first step it is aimed to approach the customers where InMediasP is currently engaged. Therefore, and for acquiring new customers reference business cases have to be developed in order to illustrate the benefit of the new solutions.

4.12.2.1 Enhancement of PLM Systems

Associated with new processes in product lifecycle management there are needs for IT tools with new functionality in order to support these processes best possible. Along with the consultancy services the existing IT tools need to be enhanced and adapted. In particular the following tool enhancements will be requested by companies that apply PLM systems

- Enhancement of PLM systems to support management and feedback of field data
- Enhancement of PLM systems to support knowledge management for BOL (product development)
- Enabling PLM systems to be used in all product lifecycle phases

Since many companies that are developing and manufacturing products already have PLM technology in place, for them it is only a minor step to enhance the existing technology in order to support many processes different from the typical straight forward engineering. In this area there is a good chance to place new businesses that combine consulting services and implementation, especially for providers of consultancy and IT like InMediasP.

Value proposition

Based on the new or enhanced processes along the product's life a widened support by PLM systems will be required. Therefore the functional scope of the PLM systems has to be enhanced in order

- to provide new functions for the processes that typically use PLM tools and
- to support for the first time processes that have never been used PLM tools due to missing functionality.

The enhancement of PLM systems will be carried out by customising and system modification (application development).

Architecture of value creation

The business opportunity of enhancement of PLM systems can be understood as an inevitable supplement of the consultancy services in the area of lifecycle integration (see also chapter 0.0□□). InMediasP plans to offer here a complete solution from the concepts over the tool enhancements to on-site support and training. The enhancement of PLM tools can be done by InMediasP for the PLM systems

- mySAP PLM,
- UGS Teamcenter, and
- Dassault SmarTeam.

For other PLM systems InMediasP will do the enhancements and modification together with partners, either the vendors itself or third party suppliers.

4.12.2.2 Enterprise Application Integration

Another new business opportunity for InMediasP is the provision of integration solutions in the area of PLM. The exploitation of the PROMISE results requires process-related IT in all product life phases. This leads to further requirements on integration of heterogeneous system landscapes. This fact is caused by several reasons. On one hand, in the different lifecycle phases of a product totally different tools are used, such as:

- BOL: CAD/CAM, PDM, ERP, PPS, Requirements Management Tools, etc.
- MOL: Maintenance Planning Tools, Operational Data Logging Tools, etc.
- EOL: Disassembly Planning Tools, Value Assessment Support, etc.

Data from all tools and phases may be needed by other tools in different phases, maybe in a different context and of course for different purposes. Therefore the exchange of data across tool and phase borders has to be enabled.

On the other hand some of the tools mentioned above are used by different companies, caused by the fact that the production, the operation, the maintenance, and the dismantling is carried out by different companies. This requires that the exchange of data or the access to IT systems has to be facilitated across enterprises as well.

Value proposition

The demands mentioned above lead to very promising business opportunities in the area of Enterprise Application Integration (EAI). It includes both, consultancy services in order to develop integration concepts (architecture, semantic mapping, etc.) as well as the implementation of the application integration.

Another integration aspect can be derived from the demand of the provision of a single point of access to heterogeneous IT infrastructures without specifying type or sources of requested information. This can be achieved by the application of integrated web-based user interfaces (portals). This means, that information from different sources such as databases, file systems and internet/intranets will be presented in a homogenous user interface where the origin of information is not relevant for the user and has not to be considered during the use of an application.

The PROMISE Portal that will be developed as the single user interface for PDKM/DSS has to fulfil several integration tasks. Hereby the portal technology will be applied in order

- to spread user requests to different information systems and
- to unite the results and present them in the user interface.

The development of portal-based integration methods and technologies enables InMediasP to set up new products in this field.

Architecture of value creation

The realisation of this business opportunity in terms of brining the created services into market, it will be necessary to generate reference solutions. There is a severe competition in the area of integration solutions. To get a unique selling point is only possible by concentrating on selected integration problems. Due to the fact that the PROMISE results in general can evolve into new technical solutions for the product lifecycle management, information has to be distributed across company departments or even different enterprises.

InMediasP aims to set up a reference environment where the improvement of processes can be demonstrated by using product-related information from all phases in all phases. Thereby the integration of IT systems from different domains is inevitable.

4.12.2.3 Transformation Process for 'Design for X' (DfX)

PROMISE focuses on the transformation of data into knowledge to support DfX aspects in the product development. In order to support these transformation processes experience and knowledge of the design specialists have to be analysed and understood first. InMediasP expects to build up know-how in how to transform data and information into knowledge to be able to provide solutions in these domains.

Value proposition

InMediasP will provide services for manufacturing industry in order to improve the product development processes. In this particular case the improvement aims for designing products while taking into considerations aspects such as reliability, maintainability, availability, safety, environment, and lifecycle costs. The provided services include

- process design,
- IT concepts,
- enhancement of PLM tools, and
- training.

Architecture of value creation

To exploit the PROMISE results in the area of DfX support it will be necessary to generalise the developed approaches in order to provide solutions for different industries. The portfolio must contain rather universal services than solutions that are specific to a certain industry.

Once these services are completely defined, there is a good opportunity to bring them to market. Since the DfX aspects become more and more relevant in product developing companies, the demand for DfX support will increase soon. In general the services mentioned in section 0 will be provided by InMediasP entirely. Although, in some cases it can be necessary to cooperate with the vendor of the PLM system, e. g. the needed enhancements cannot be done without modifying the system basis.

4.12.2.4 Revenue model

As mentioned in the business model description InMediasP earns money basically with the provision of consulting and IT services on the basis of customer projects. With the results of PROMISE InMediasP will be enabled to expand its revenues in two different ways:

- The offering of consulting services and IT solutions to enable a more complete product lifecycle management including the feedback of field data can result in new projects that are larger than the projects that are currently carried out or in projects that address completely new areas. This will increase mainly the turnover that is made with the currently existing customers.
- Totally new industries can be addressed by some of the services that InMediasP can provide on the basis of PROMISE results. Currently the offerings focus very strong on the product development area of manufacturing industry. With the new processes and PLM solutions also companies or departments of the other areas like maintenance or dismantling can be addressed. This will lead to completely new customers for which currently no offering in InMediasP's service portfolio exists.

The current share of the different business areas of the annual turnover is shown in Figure 5. The main growth of the turnover which is based on the PROMISE results is firstly expected in the areas consulting and IT services since the new processes have to be designed before innovative IT solutions can be introduced.

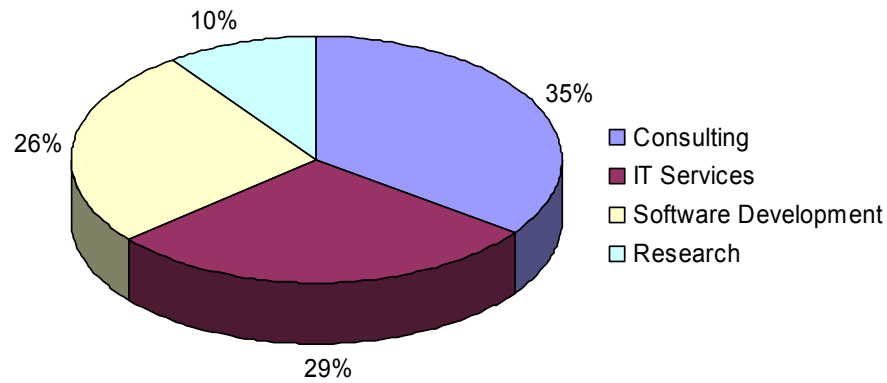


Figure 5: Business area's share of the turnover

Since the new products based on PROMISE results have to be developed thoroughly the first influence on the turnover is expected in 2007. Based on InMediasP's annual turnover in 2005 which was roughly about 3 million Euro, the increase of the turnover on the basis of PROMISE results has been estimated for 4 years starting in 2007 (see Figure 6).

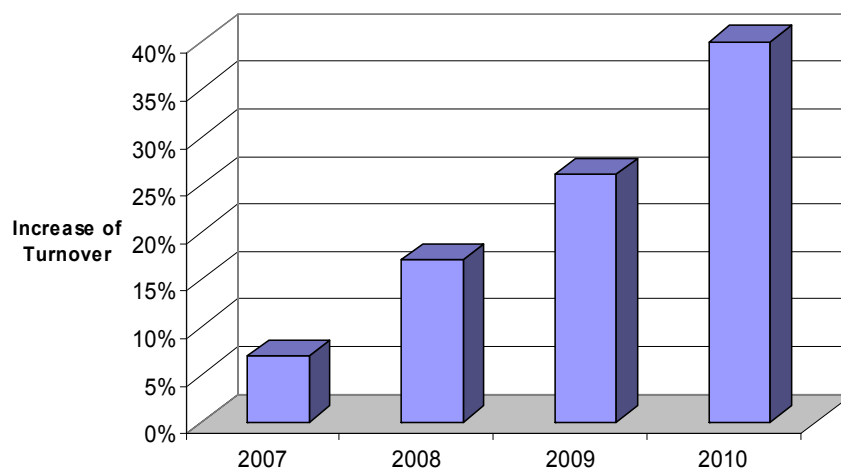


Figure 6: Planned turnover growth based on PROMISE results

Along with the planned growth of turnover the increase of staff has to be realised. Due to the fact that the revenue of InMediasP is – different from companies that sell for example software on a licence basis – directly linked to the performance of projects, the growth of the staff and their education is inevitable. Table 1 shows the planned staff increases for InMediasP based on PROMISE results.

Year	Staff Increase	Staff Increase (cumulated)
2007	2	2
2008	3	5
2009	3	8
2010	4	12

Table 1: InMediasP's planned increase of staff based on PROMISE results

The current pricing model of InMediasP based fundamentally on different hourly rates for the consultants and software developers depending on their expertise or their role in a project. The exploitation of the PROMISE results does neither change InMediasP's business model nor its pricing model in principle. However, the opportunity of providing more complete solutions on one hand and to achieve a unique selling point for particular services legitimates partly an increase of the rates.

InMediasP does not plan to sell software on a licence basis. This means that all software development services will be combined with the consulting services. This includes PLM system enhancements as well as tools (application development) and integration solution. Thus, all software solutions will be covered by the Revenue model described above.

4.12.3 Corresponding market view

Since years the PLM market is growing heavily, and this trend is continuing for the time being. Currently PLM touches more and more all phases of a product's life and the entire value chain. This includes increasingly the areas operation/in service, maintenance/repair and dismantling/decommissioning. It can be stated that also smaller companies increase their investments in PLM technology [1]. Manufacturers building out supply chain platforms recognize the importance to build in processes management from conceptual ideas to end of life [2]. Noticeable is that the vendors provide increasingly PLM solutions that can support small and medium sized companies.

The market growth includes both, software as well as services, while the services have a slightly bigger share in the business [1].

A still valid shortcoming of existing PLM technology is that customer needs and field data are still missing from PLM [3]. As the PLM footprint finally begins to take shape, the piece that remains the most embryonic is the idea of funnelling customer-needs data and post-sales feedback into the product database of record to compose a complete history of the lifecycle. Linking customer requirements data and post-sales feedback with the product record is beneficial for product quality and supports successful product launches. This gap, especially the deficits in managing field data, can be bridged perfectly by consequently developing and improving the PROMISE approaches.

Another functional area requested by PLM appliers reappears with a growing IT in the area of Digital Manufacturing is the support of DfX (Design-for-X; X stands for assembly, manufacturability, reliability, maintainability, cost, etc.) [4]. Due to a lack of product-related information from post-sales phases in existing PLM systems a sufficient solution to support DfX processes has not been provided until now.

It can be summarised that the PLM market is immense and still growing. But the PLM software market as well as the services market is changing within the next years. Starting from the point where the tools and services focused mainly on the development phase of a product nowadays the PLM spans more and more the later lifecycle phases. This implies that beside an increasing amount and variety of data that has to be managed also different processes have to be supported by new functionality.

These areas can be covered by several of the results that will be obtained by PROMISE. However, these results are not marketable directly. They have to be adapted after the PROMISE project in order to meet the market's requirements.

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4.13 ITIA-CNR

ITIA-CNR is the Institute of Industrial Technologies and Automation of the National Research Council. The National Research Council (CNR) is a public organization; its duty is to carry out, promote, spread, transfer and improve research activities in the main sectors of knowledge growth and of its applications for the scientific, technological, economic and social development of the Country.

The activities of the organization are divided into macro areas of interdisciplinary scientific and technological research, concerning several sectors: biotechnology, medicine, materials, environment and land, information and communications, advanced systems of production, judicial and socio-economic sciences, classical studies and arts.

CNR is distributed all over Italy through a network of institutes aiming at promoting a wide diffusion of its competences throughout the national territory and at facilitating contacts and cooperation with local firms and organizations.

From the financial point of view, the main resources come from the State, but also from the market: even 30% of its balance sheet, an extraordinary result, is the result of revenues coming from external job orders for studies and activities of technical advice as well as from agreements with firms, contracts with the European Union and with the other international organizations. ITIA – CNR, as a promoter of industrial innovation, performs strategic activities of Scientific Research and Technological Development for the Competitiveness and Sustainability of Italian and European Manufacturing Industries.

4.13.1 ITIA – CNR's business model

ITIA-CNR has evolved from a private research institute of the national machine tool association into a national public and privately funded institute for R&D and training involved with machinery, manufacturing systems, and production management. ITIA-CNR has a long tradition of research on mechanical components for machine tools and has devoted its interest to Factory Automation, increasingly based on Automatic Design, Production Management and Innovative Production Technologies.

The RTD activities of the Institute aiming at innovating Products, Processes and Organisation refer to the following research areas: Innovative Mechanical Components, Machine and Manufacturing, Control Systems, Advanced Systems for Mechanical Machining, Industrial Robotics and Automation Systems, Industrial Metrology, Reliability, Maintainability and Thermal Analysis, Dynamic Analysis and Simulation of Machinery, Simulation and Engineering Applications, Virtual Manufacturing Environment, Supply Chain and Production Management, Extended Evolving Enterprise. Further strategic activities of ITIA are: the Management of International Programmes and Projects (e.g. Eureka Factory DNA Programme, the integrated projects “CEC-made Shoe” and “KOBAS” within the thematic programme “Nanotechnology, Materials and New Production systems” of the Sixth Framework Programme); a permanent Observatory for Technologies of foresight studies on strategic needs for the technological innovation within the main manufacturing sectors; Services to enterprises and Innovation as the validation of industrial prototypes and solutions of manufacturing problems; Education and Training activities through schools (eg. Master in Industrial Research), RTD projects, forums and seminars for the enhancement and dissemination of the manufacturing culture.

The institute is structured as a net including also some Laboratories spread all over Italy, specialized in different manufacturing sectors as Design and Mass Customization for shoe manufacturing, wood technologies, mechanical control.

The institute has for years provided research-related services to Italian Industries, aimed mainly at the development of innovative prototypes in various industrial fields, fostering the adoption of new design approaches and of new technologies in industries by actively participating in the launch and organisation of joint research consortia between academic bodies and private companies.

The researchers are actively involved in teaching university courses at the highest level and they offer courses and training internally for industry and associations. Close co-operation with

industry associations like UCIMU, ASSOMAC, etc. has created trust with industry and presently the institute is involved in a large number of national and international projects with Italian companies in order to improve and create the next generation of manufacturing systems.

4.13.2 Description of new business models

For its particular nature of Research Centre ITIA – CNR will not be involved in a commercial exploitation. ITIA-CNR has a good base in disseminating and exploiting the results of PROMISE thanks to its key-role in the Italian and European research context.

For these reasons ITIA-CNR can contribute to spread the project results through conference presentations and exhibitions and it can also support investigation of the industrial demand and market opportunities and evaluation of the related benefits using innovative methodologies like LCC.

Moreover, ITIA can derive best practice-cases concerning the DSS prototype developed in the two application scenarios where it is directly involved (A4 and A6). This can be used to derive academic publications and to prepare lectures training on this topic for auditors from industrial and academic world. The DDS structure defined could provide material for services and consultancies offered to industries from similar sectors. It will also be evaluated the opportunity to extend the approach and related tools to different industrial sectors. This methodological approach could be used as basis or input for further research and technological transfer projects.

4.13.2.1 Value proposition and Architecture of value creation

For the above mentioned reasons the value gained from a project like PROMISE for ITIA – CNR can be summarized as follow. Basically ITIA is interested in strengthening its position in the field of life cycle management, improving and extending its competencies, since this topic is getting more and more important for European companies in the future.

4.13.2.2 Revenue model

ITIA is a no-profit organization and is funded by the National Research Council of Italy but it has reached over 60% of self-financing. Research activities are supported by several funding sources at national (CNR, Target Projects, SPI research programme), European (Eureka-Factory, Brite-Euram, Esprit, thematic Networks), and world-wide level (IMS programme), in co-operation with Companies, Universities, and Research Centres.

As ITIA is normally not implementing solutions or selling products its Revenue model is not based on calculations of impact for customers. For these reasons ITIA Revenue model differs from industrial partners or software providers' one in the PROMISE project, as for other similar research partners.

4.14 SAP

Within the past decades, software has become the engine of business success, facilitating best practices, streamlining processes, and enabling high-level analysis of performance and trends. Being the No. 1 in enterprise applications software worldwide and No. 3 in software overall SAP is the recognized leader in providing collaborative business solutions for all types of industries and for every major market [SAP Annual Report]. SAP's enterprise application software product offerings (see Figure 7) are run by more than 32,000 customers in more than 120 countries. 75% of the Fortune Global 1,000 companies run SAP software [SAP investor fact sheet].

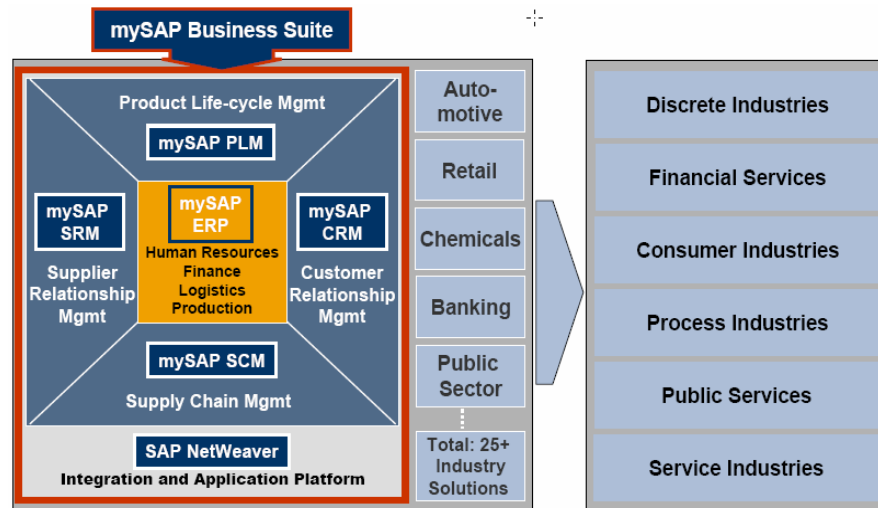


Figure 7: SAP's Enterprise Application Software

4.14.1 SAP's business model

SAP offers industry-specific software solutions to large, small and midsize companies in different industry sector such as automotive, banking or the public sector. In addition, SAP provides its customers with business support, consulting and training services, giving the company a well-diversified revenue stream. Figure 8 represents SAP's business model with regard to its major revenue streams "sales", "implementation", "maintenance" and "training" in combination with the respective revenues in 2005.

Moreover, that model is surrounded by a strong and well-established partner network. Among others, the network consists of service and software partners as well as technology or hosting partners. That partnering concept turned out very valuable as SAP - like many other technology vendors – recognizes not being able to provide single-handedly top-to-bottom services to all of its customers. Therefore, SAP has recruited solution-provider partners over the years, including system integrators, valued-added resellers, independent software vendors (ISVs), and others, to help sell, implement, and develop software add-ons or microvertical solutions for SAP's solutions [SAP INFO, 2006]. Companies recognize SAP as a strong, reliable partner and trusted advisor for innovating business with IT, reflected in the 17% increase of the SAP share in 2005.

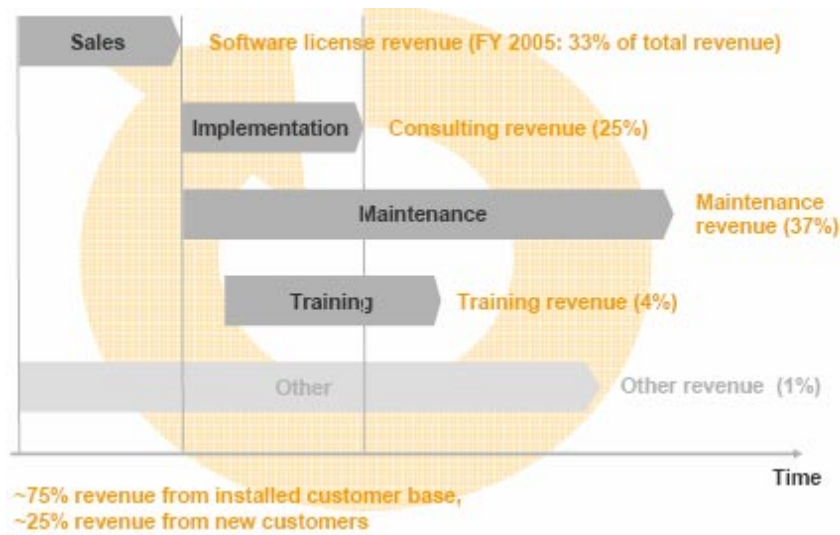


Figure 8: SAP's business model

4.14.1.1 Technology transfer into SAP

Being one of SAP's roll-in channels for new technology the research department SAP Research contributes to SAP's product portfolio by identifying breakthrough innovation and conducting co-innovation with external partners and customers. SAP Research acts as IT trend scout in strategically important SAP business areas. Therefore, SAP Research identifies technological trends, analyzes these in terms of their potential for innovative software solutions or new business models and establishes the corresponding application scenarios. In general, projects are supported by external research partners, technology partners and users, e.g. in EU consortiums such as PROMISE. The following figure represents the early stage of innovation management: SAP's research process. Crucial for each transfer into SAP are the feedback and forward loops as well as a close cooperation with SAP product development as sketched in Figure 9.

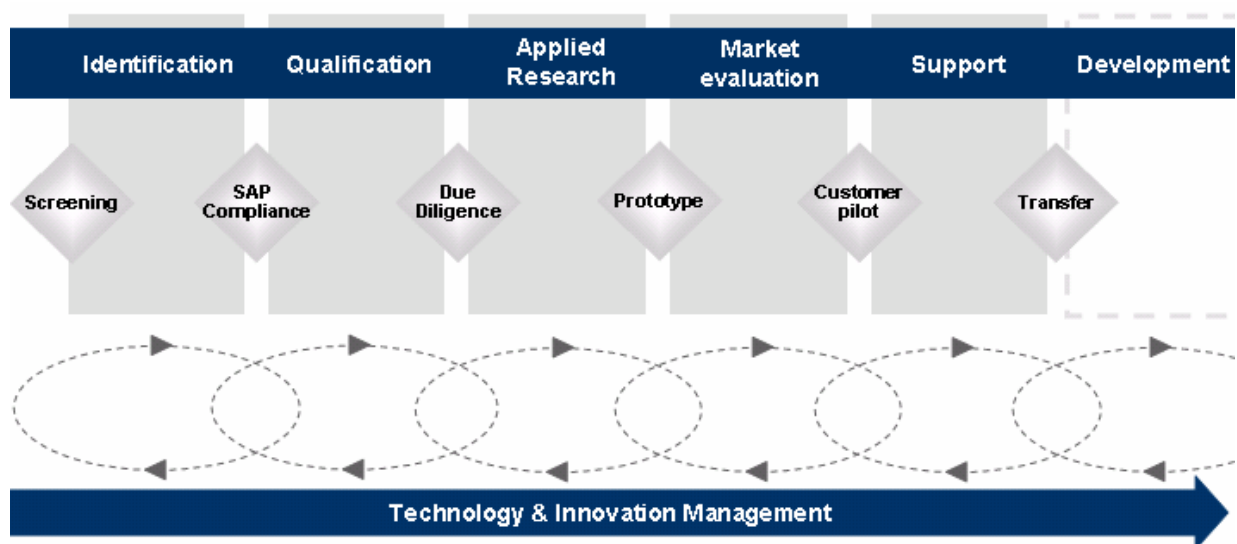


Figure 9: SAP's research process

In order to provide insight into the research department's modus operandi, the example below illustrates SAP Research's role in the concept and development of the SAP Auto-ID Infrastructure (AII). The AII is a middleware component for integrating RFID-data into SAP backend-software. The concept and early pilots of this component have been developed by SAP Research in conjunction with several of the company's product and industry teams" [RFID Journal].

4.14.1.2 Example: Transfer efforts into the SAP Auto-ID Infrastructure

Screening of Radio Frequency Identification (RFID) as well as market research and initial discussions with logistics experts already started in 1998 and enabled SAP to early recognize the potential of RFID:

- In 1998, SAP Research developed a generic interface for RFID readers that enabled communication with SAP business software
- In 1999, SAP used a supermarket cash register at SAPPHIRE – SAP's customer trade fair - to draw public attention to RFID. Customers could use the cash register to check out their merchandise on their own. A year later, a check-in device was unveiled at SAPPHIRE which automatically recorded incoming goods
- By 2001, SAP Research had developed the concept for a Smart Items Infrastructure, allowing a server based solution for processing data volumes that had been collected with a variety of readers. The prototype was first presented at SAPPHIRE 2002
- SAP became a founding member of two research organizations, the Auto-ID Center at the Massachusetts Institute of Technology, and the M-Lab at the Swiss Federal Institute for Technology at the University of Sankt Gallen
- Together with Metro Group and Intel, SAP started the "Future Store" initiative and provided the RFID software components for the "Future Store" in Rheinberg
- In 2003, a pilot project was started at Frankfurt airport to inspect the exhaust valves of the airport buildings. It was based on a mobile infrastructure with an interface to RFID readers, developed largely by SAP Research
- In 2004, the new SAP Auto-ID Infrastructure was introduced in initial client applications. It integrates RFID with business applications and became part of mySAP SCM. The solution is based on the Smart Items Infrastructure prototype, developed entirely by SAP Research.

Figure 10 summarizes SAP's milestones in the area of RFID over the past years. This example underlines the importance of applied research spanning a timeframe of several years from technology evaluation until product release. In the early phases, SAP's involvement in RFID was mainly driven by SAP Research with the focus on technology. Once the main technology issues were solved, the market analysis and a business model triggered the development of the Auto-ID product.

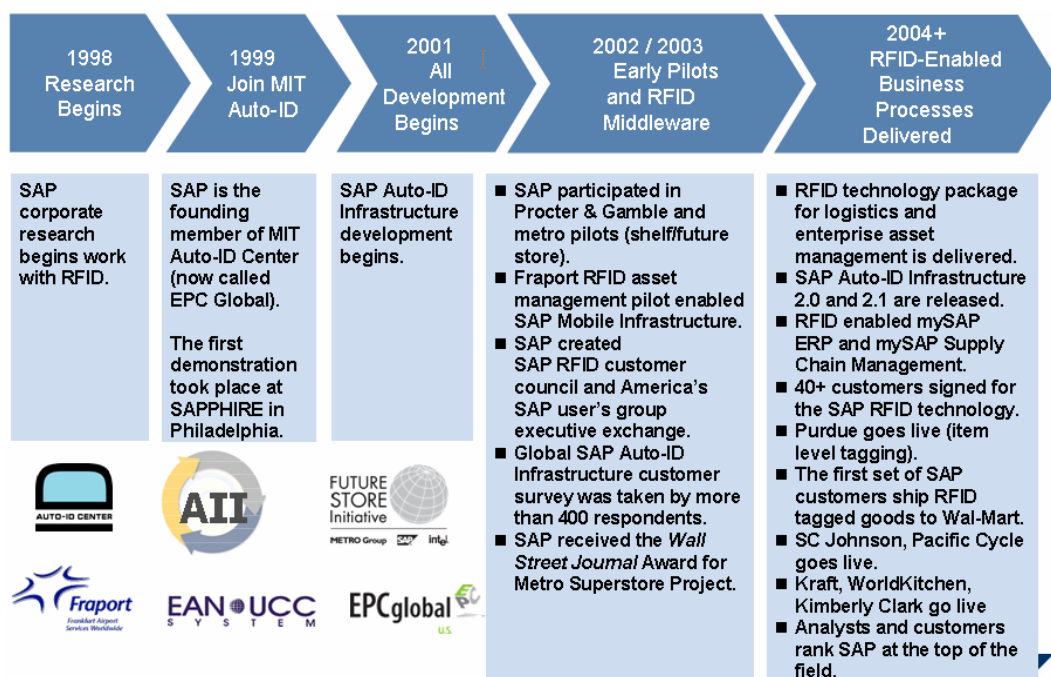


Figure 10: SAP – years of experience in RFID

Today, the SAP RFID application allows its customers to successfully close the loop between acquiring data, converting it to meaningful information, and automating all associated transactions and processes.

4.14.2 Description of new business models

Following the approach described in section 4.14.1.1, SAP Research has identified a number of business scenarios in the PROMISE context as new business opportunities for SAP. In most instances, these scenarios apply to the manufacturing industry, respectively its subareas automotive, railway, mining or milling. In a first step, dedicated business processes are presented. A brief description outlines the business opportunity and added value identified by PEID-enabling the business process. The business processes are organized according to the areas

- Enterprise Asset Management
- New product development
- Process engineering

4.14.2.1 Enterprise Asset Management

Asset Management describes the method or process a company tracks, monitors, and manages its assets, such as factory equipment, computers, or even buildings [Wikipedia] in order to maximize asset ROI. In the application areas listed below asset management has become of strategic interest:

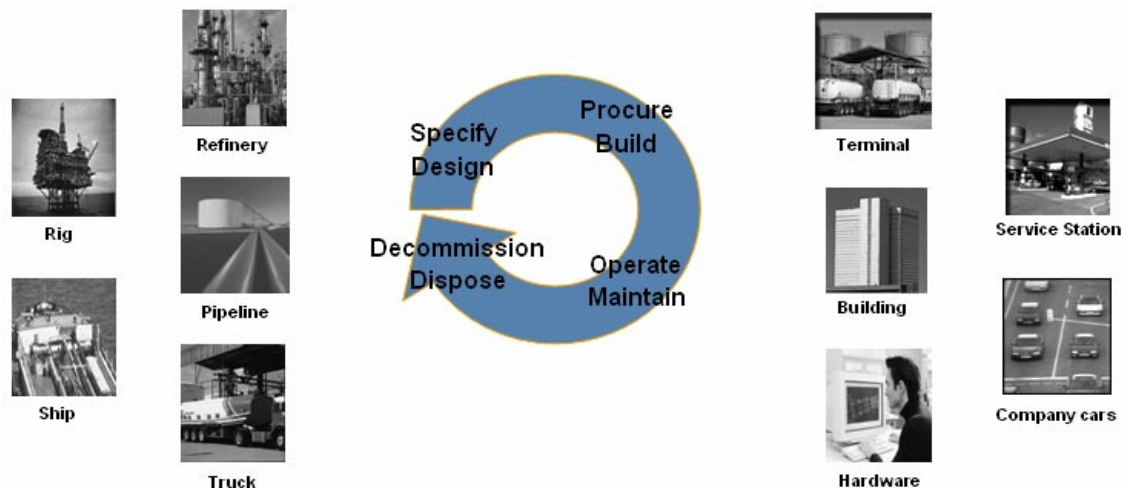


Figure 11: Enterprise Asset Mgmt targets capital-intensive industries

Enterprises collect asset data not only for inventory reasons, but also for documenting and managing the total cost of ownership, depreciation, licensing, maintenance, and insurance. Moreover, the data often becomes the basis of strategic investment planning. EAM mainly targets project managers and maintenance engineers who are in charge of all kinds of physical assets and equipment from the first investment idea to the end of operation and replacement of assets. Taking a closer look at the PROMISE industry end user scenarios and the requirements they addressed with regard to EAM we identified the following key issues:

- Expensive delays in time to repair caused by long delays due to availability and mobilization time and slow turnarounds
- Soaring operating expenditure caused by high costs for production interruptions

By improving maintenance and repairing operations processes PEID technology is able to reduce asset unavailability, directly impacting the return of investment (ROI) of each asset. In the following we briefly introduce dedicated EAM processes that address those key issues and might be enhanced by PEID technology:

- Fleet management
- Inventory and spare parts management
- Preventive and predictive maintenance
- Asset performance
- Outsourcing maintenance services
- Asset refurbishment

1. Technical asset management - fleet management

Fleet management is an example of technical asset management, concerning the operations and maintenance of transport objects (road, rail marine, air, and pipeline). It enables companies to document fleet operation and consumption, covers preventive and malfunction-based maintenance processes, including e-procurement or refurbishment of spare parts, and ensures versatile performance evaluations to help optimizing fleet utilization. The following figure represents the current process:

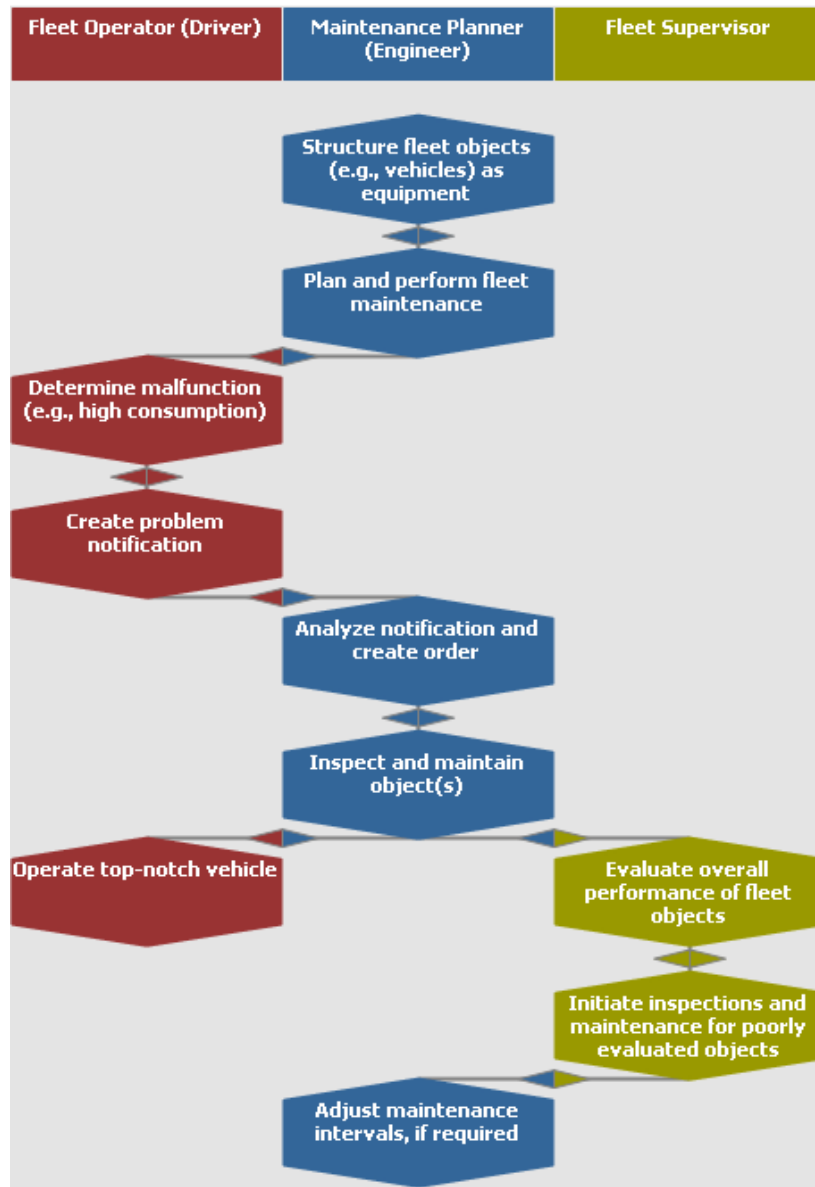


Figure 12: Fleet management process

Process description

The fleet master data record allows special input of relevant information for fleet operation, such as identification data, replacement data, engine information, fuel and lubricants data, dimensions and transport-relevant information.

For fleet operation, one can also document and check consumption data, which includes the upload of externally recorded refuelling data. With the asset life cycle management's full functional scope at hand, fleet management allows streamlined preventive and malfunction-based maintenance (see previous section) within the work order cycle, offers illustrated parts catalogues for component planning and e-procurement or integrated refurbishment of spare parts (e.g., tires). A complete fleet list reveals all the information needed to evaluate vehicle

performance. Versatile reporting features in the SAP Plant Maintenance Information System (PMIS) allow accurate performance evaluations to help run fleet at capacity.

Value proposition

Theoretically, each relevant part of a company's fleet can be made "smart" by PROMISE technology, like in the scenarios provided by Bombardier and Fiat. Static data, i.e. IDs, replacement data, engine information, etc., all can be stored directly on the means of transportation. This information can then be read and utilized wherever it is needed, for example at gas stations, distribution centres, garages or at borders. The information can automatically be updated, for example when a truck engine is changed. At borders it will be possible to inform the truck about the speed allowed in the country.

PROMISE can also improve the reporting capabilities of the software system on vehicle performance. A basic computation of vehicle performance may be performed by PEIDs, allowing to inform the back-end system about aggregated performance data or to inform the back-end system only if the performance is lower than expected.

With a PEID determining the location of the hosting vehicle, it is possible to monitor the current location of every part of a company's fleet, their current speed, the transportation route and also information about the items that are currently carried. The data quality for assessing vehicle performance will therefore be improved and the information can be used for further improving vehicle performance and optimizing fleet capacity.

2. Maintenance planning and execution - Spare parts management

A further critical component of an effective EAM is the proper planning and control of the spare parts inventory. Production interruptions and downtimes might be expensive consequences of delayed repairs as the PROMISE end users already have remarked. On the other side, if redundant spare parts are hold on stock, the enterprise absorbs excessive costs and the overhead of carrying the inventory. The following figure represents the current process:

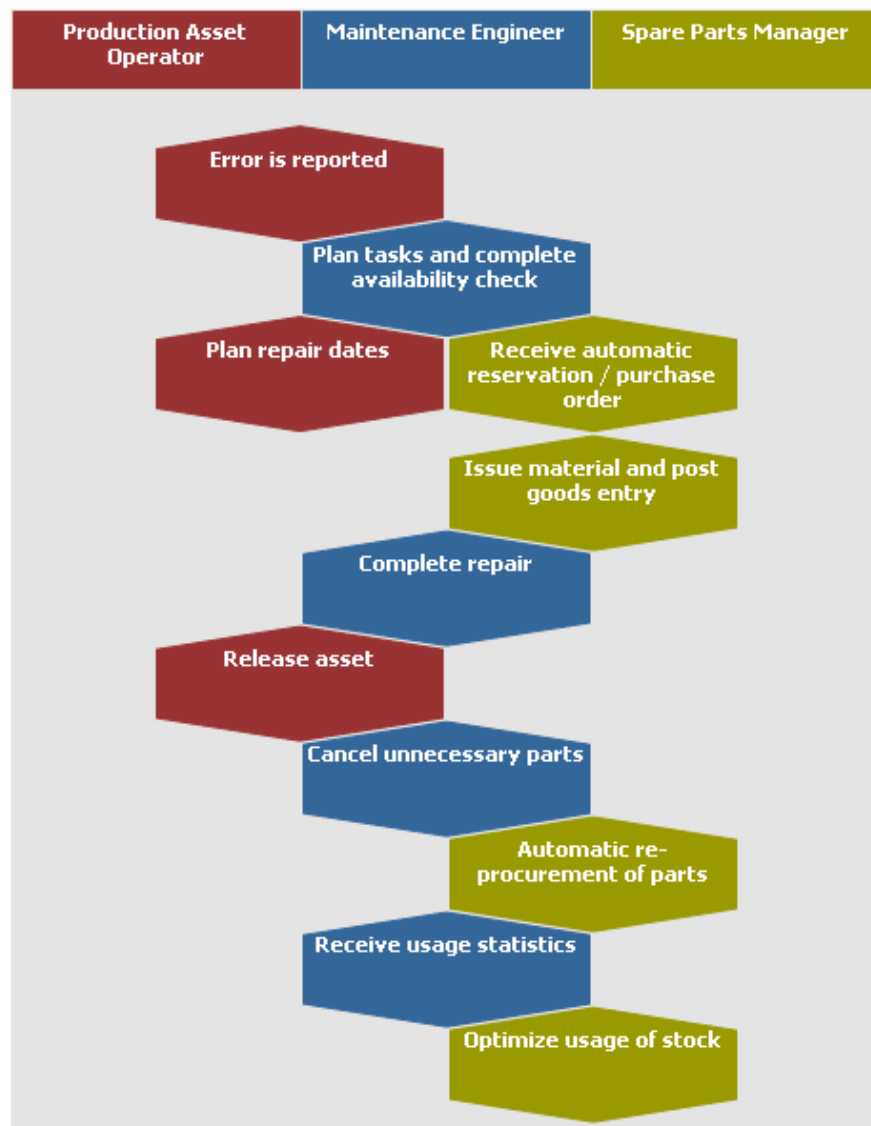


Figure 13: Spare parts management process

Process description

Optimal spares provisioning is a prerequisite for all types of maintenance tasks, such as inspections, preventive maintenance, and repairs. With the exception of scheduled preventive activities, spare parts for maintenance tasks are usually required at random intervals. Thus, the fast and secure coordination of the demand for spare parts with the supply of spare parts at the required time is an important factor for the punctual execution of the maintenance process. Missing materials are one of the most frequently cited reasons for the delay in completion of maintenance tasks. As spare parts for machinery are often machine specific and of high value, this problem cannot be solved simply by increasing the warehouse stock. Note that this type of problems is found within the PROMISE scenario provided by Caterpillar.

The maintenance execution process, as it is implemented today in mySAP PLM (see section 4.14.2.4), helps a maintenance planner to get an overview of potentially necessary parts and their availability, right from the moment a problem occurs. If a concrete maintenance task is planned in a further step, the system determines and logs the exact availability of the materials at the

required time, regardless of whether the materials are in stock or must be procured externally. The replenishment lead time of the spare parts can also be determined by this process. If this is further in the future than is reasonable, the maintenance engineer can consider exchanging an asset instead of repairing it.

Assets can also be managed in stock and considered in the same way as materials for planning purposes. The system issues reservations and purchase requisitions, which can be processed by the relevant departments in the spare part industry. Thus, all those involved, from production to purchasing and storage, via maintenance, have complete transparency about the material availability and the possible completion of the task. The planned material costs in the task are documented in the same way. The material withdrawals are documented by the system and form the basis of usage-controlled materials planning. With this process, material stocks of spare parts can be optimized to support maximum availability with minimum stock.

Value proposition

Similarly to the above, this process can also be enhanced when assets as well as spare parts are equipped with PEIDs. Here, spare parts could store information, such as ID, type, location, existence of reservations for this part, helping order to improve the spare parts management process. The “smart” asset could then collaborate with the spare parts available in the plant. In order to achieve this, an asset will first have to determine which part of it needs replacement or a maintenance worker needs to find out which spare part is needed.

The task of the maintenance worker can be supported by manuals or assembly information that is locally stored on the asset’s PEID. The asset can then autonomously check whether a spare part is available and directly request this spare part. If no spare part is in stock, the back-end system will receive a message to order the missing spare part by a supplier. The required lead times for delivering spare parts will be more precise if all spare parts are equipped with PEIDs. The spare parts that are directly available could then store reservation information including the period of time for which the reservation is made, who issued the reservation and for which machine the spare part will be needed. Automatic checks can be imposed to prevent that any spare part is taken from its storage shelf while its state is “reserved”.

3. Preventive and predictive maintenance - condition-based maintenance

EAM enables companies to plan preventive and predictive maintenance activities, based on time, counter, condition, or risk. It also lets them schedule individual maintenance tasks and allocate required resources, tools, and materials, and plan shutdowns or turnarounds as large-scale maintenance projects. Condition-based maintenance is an example of a process that covers preventive and predictive maintenance (see Figure 14 below).

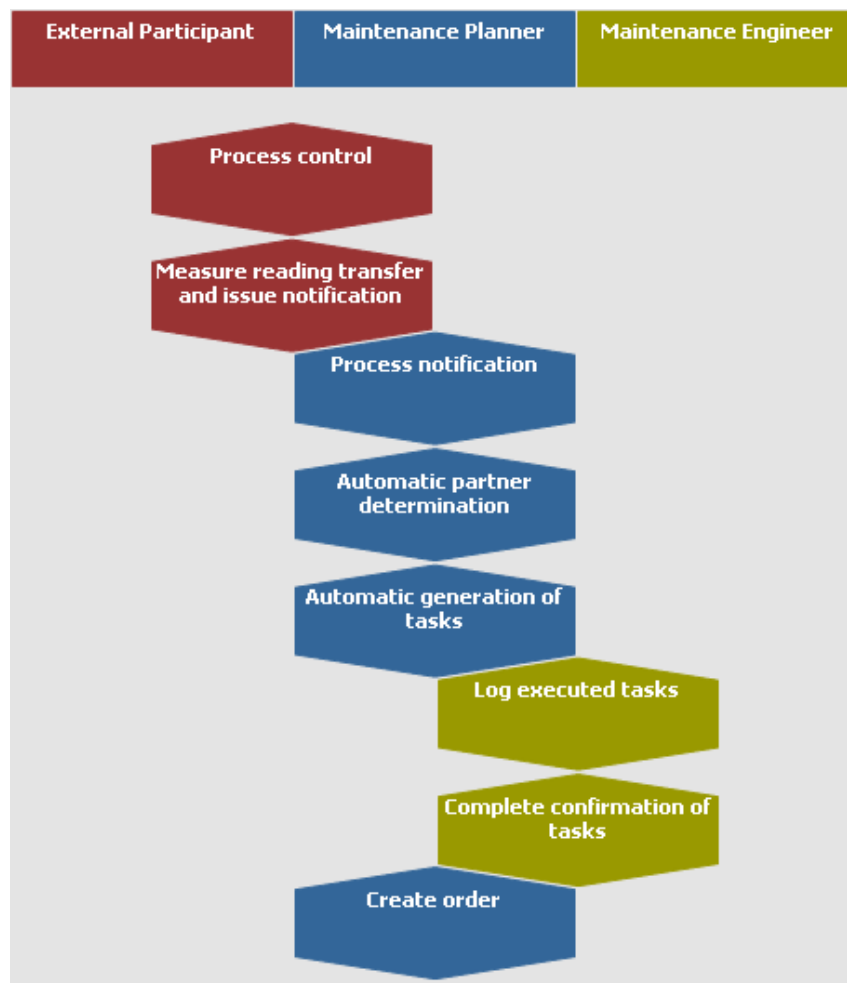


Figure 14: Condition-based maintenance process

Process description

Today, the process that is implemented in the mySAP PLM system (see section 4.14.2.4) is typically executed as follows: An optimal asset condition is a prerequisite for a trouble-free production process. Triggered by a malfunction report created by the Process Control System in the ERP system, the maintenance planner decides to send out a maintenance engineer to the reported object to validate the reported malfunction. The responsible engineer for this task is automatically determined using partner determination and is informed using a pager, telephone or workflow. In addition, the response profile, service profile, and, if necessary, priority, are used to automatically determine the tasks that must be executed for this report. The responsible maintenance engineer executes the tasks assigned to him. This is logged within the report. He analyses the reported damage on site and notifies the maintenance planner of his results using the report. On the basis of the completion confirmation, the maintenance planner can now decide whether a maintenance order must be created.

Value proposition

For supporting this maintenance process with PROMISE technology, assets need to be equipped with PEIDs with the appropriate sensors that are able to determine the condition, e.g. temperature, or vibration, of the asset. This way, a constant monitoring of the asset conditions can be

implemented that also leads to much higher data accuracy. Based on this data assets will be able to send a notification or alert to the back-end systems if they need maintenance.

Based on the analysis of sensor data, it will also be possible to predict and plan next maintenance activities. Based on these predictions, “smart” assets could also collaborate on determining the best point in time for ordering a maintenance engineer automatically, so that the person in charge of the assets needs to come on site only once. These additional features that cannot be supported by current software solutions can motivate customers to apply PROMISE technology.

To support this process, PEIDs will store some static asset relevant data (e.g. maintenance required every 3 months) and also have sensors to capture the asset’s state (mechanical stress, pressure, etc.). PEIDs must also be able to store and check rules and conditions that reflect when an asset needs maintenance, and should also be able to notify either the back-end PLM system of a malfunction or other PEIDs in the neighbourhood.

4. Asset performance analysis - Optimizing asset effectiveness

On the basis of frequent problem notifications for a technical asset this process automatically guides the responsible person to the weak spot within the maintenance process. The optimization process can particularly be supported with high quality data that helps to improve the quality of the resulting decisions. It aims at firstly localizing any weak spot, then to determine the causal factors for the problem and finally to provide a basis for deciding how to proceed with the asset, taking into consideration its age and maintenance cost.

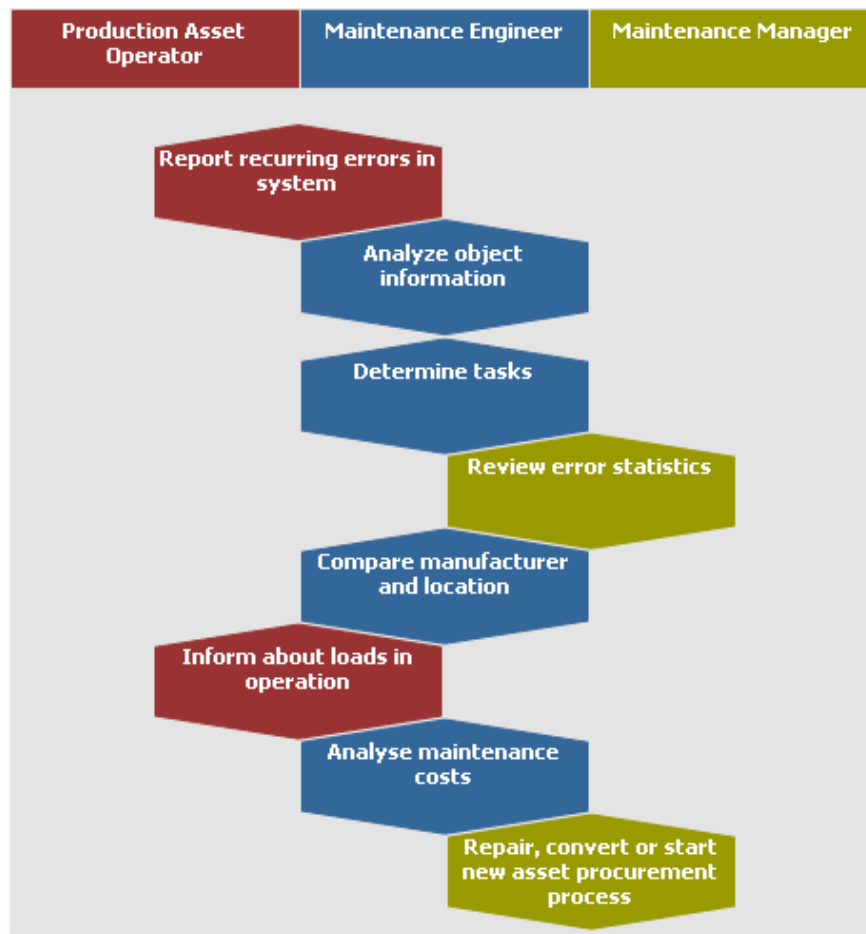


Figure 15: Optimizing asset effectiveness

Process description

Alternatives to choose from would include, for example, repairing, modifying, or replacing the asset. In further steps of the process, people responsible for the asset analyse the existing error statistics for the technical object, using various locations as a basis for comparison and comparing the same type of assets from different manufacturers. The asset user is informed about the results and can contribute further relevant information. Thus, special factors which are not documented in the tasks can be retrieved. Along with the technical factors and maintenance costs, the book value and ownership structure of the asset also play a decisive role in deciding whether to opt for repairing, modifying or replacing the asset.

Here is an example of how the process is executed today: The asset operator pinpoints a malfunction in a technical object and issues a malfunction report. The responsible maintenance engineer analyses this malfunction report. During the analysis of the report, the so called “object information” notifies the maintenance engineer in a pop-up window that there were several breakdowns for this object in the preceding months.

The maintenance engineer can now determine several tasks. One of these tasks is to perform a closer examination of the object using the damage history and cost history. As important and expensive assets are concerned, the maintenance manager is deemed to be the person responsible for these tasks. The list of tasks tells the maintenance manager to perform a closer examination

of the statistics of the object concerned. First, he displays the malfunction statistics, and then he looks at a certain period of time and analyses the types of damage, damage codes, and causes of damage. In doing this, he compares two similar manufacturing plants. This reveals to him that technical problems occur very frequently in one particular plant. A comparison with similar assets from different manufacturers, however, rules out the possibility of it being a structural problem.

Particularly eye-catching are the comparatively high repair costs. The maintenance manager saves the evaluation on his PC, and sends it to those responsible for production to rule out potentially production-based conditions as a cause of the high rate of malfunctions. It turns out that production conditions are making higher demands on the asset than originally anticipated. The maintenance manager uses the integration with Asset Accounting to gather information on the ownership and current book value of the asset. With the information on production demands on the asset quality, the current and the anticipated maintenance costs and the current book value, the maintenance manager proposes modifying the asset, to meet the technical requirements with the lowest possible maintenance costs.

Value proposition

This process may also be supported by the PROMISE technology mainly by delivering accurate, real-time data about the current state of assets. Here, PEIDs can store information about how many break-downs or failures occurred and then adapt its measuring intervals to this information. If many failures occur, “smart assets” can monitor their state more closely than before. Collaborating assets of the same type may also inform each other about their current state and thus improve the potential for finding unusual patterns. Multiple assets of the same type can work together and find weak spots by exchanging information about their usage and statistics.

6. Asset refurbishment

Asset refurbishment embraces the process of major maintenance or minor repair of an asset. Dedicated European directives such as the ELV (End of Life Vehicle) (EU/2000/53) mentioned in CRF's scenario today set further regulatory requirements. The figure below shows a cross-industry process that streamlines the refurbishing of serialized equipment by seamlessly integrating it with the maintenance cycle. By linking technical assets (equipment) to the material master condition-based stock management is being allowed. Any refurbishment activity has an impact on the stock value of the material (equipment).

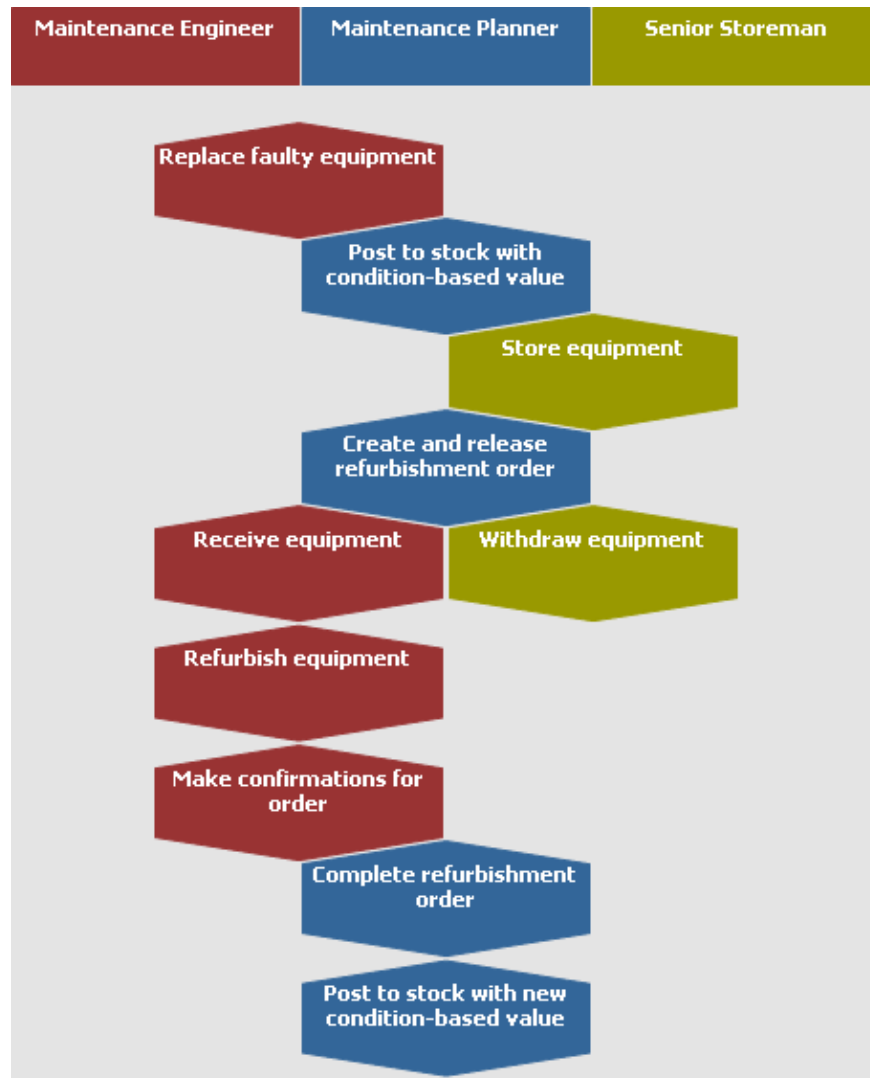


Figure 16: Refurbishment process

Process description

Due to dedicated European directives the refurbishment of equipment needs to be seamlessly integrated with the maintenance cycle. Technical assets (serialized equipment) are linked to the material master and can be managed in condition-based stocks. Any refurbishment activity performed influences the overall stock value of the material (equipment). The mySAP PLM system (see section 4.14.2.4) includes maintenance planners, maintenance technicians and storage men to form a team in the maintenance of equipment. After a maintenance technician has determined and replaced faulty equipment, the maintenance planner posts the defective item to stock. They can specify the decrease in value by setting a specific valuation type for the item. After several defective items have been posted, the maintenance planner creates and releases a refurbishment order for the given items. These will be withdrawn from stock and refurbished by the maintenance technician. After finishing the repairs, the technician can make the confirmations for the order. Subsequently, the maintenance planner completes the order by posting a goods receipt to stock using a higher valuation type. The stock value changes

dynamically according to the condition of the items, with the price of a refurbished item covering all internal and external material and labour costs spent on refurbishing.

Value proposition

PEID technology might improve the process by tracking and tracing recycling products. According to different European directives, assets such as vehicles or parts that have reached their EOL need to be reused, recycled or recovered of corresponding materials. PEID technology is able to identify and track those product components and materials that are suitable for reuse and recovery and therefore help improving the decision making process

4.14.2.2 New Product Development

New product development embraces the complete process of bringing products to the market. The figure below shows how different parties such as marketing, customers, product managers and the engineering department work together across the entire life cycle, from the initial ideas through to start of production:

- Marketing triggers a new product development process and provides input and validation concerning the product at different phases of the process.
- Product management handles the different structures in an integrated working environment throughout the whole process.
- The engineering department then works step-by-step on the different structures in the same working environment.

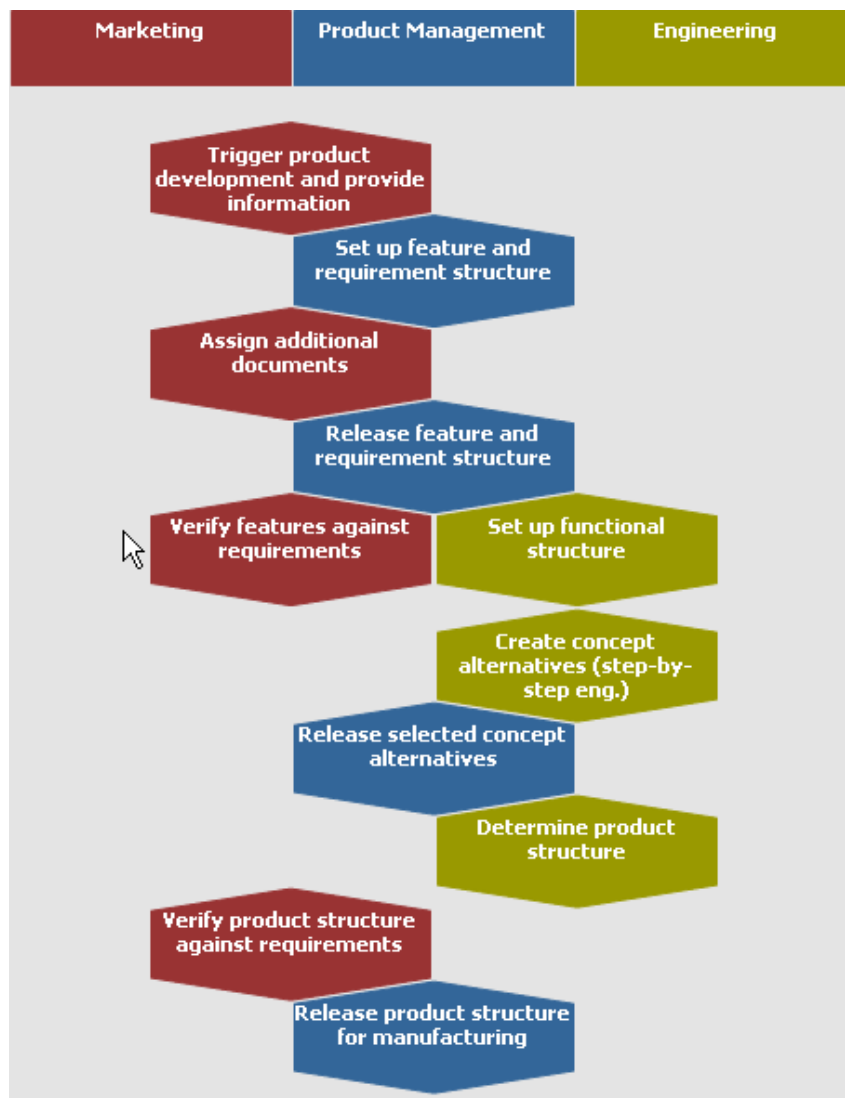


Figure 17: New Product Development

Process description

The process shown above is based on the concept that all ideas, documents, structure information, early process information and early layout information are collected and managed in one central tool: the initial idea, through production, and also after SOP, if necessary. Usually, the process is triggered by an external or internal customer, asking for a new product developed. This customer often provides the responsible product managers with thousands of unstructured or only partly-structured documents relating to the new product. Thus, product managements' initial task is to handle this huge amount of information in so-called Feature and Requirement Structures. After verification by the external or internal customer, the engineering process is

started and different phases later - from the functional structure to the concept or design structures, through to the released product structure - finally handed over to manufacturing.

Value proposition

By adding field data mainly captured by service and / or product related embedded devices the design process of new products can be improved. In addition to the customer requirement process above, PROMISE technology may track and deliver accurate, real-time data during the whole asset lifecycle, especially during the important MOL process. That means, feedback information concerning the whole product lifecycle would become available.

According to the specific industry needs, relevant data would refer to any data relative to product performance, service and maintenance. Data gathered e.g. in condition-based maintenance processes (see process description above) could flow back as DfX knowledge into the engineering process in order to design new or improve existing products or product performance (compare Bombardiers' or Caterpillars' industry end user scenario). And, as especially malfunctioning, early wearing or failure of products during MOL or EOL are closely linked with its design process or its production process new product development could be enormously improved by tracking the status of products during their use and disposal.

4.14.2.3 Process engineering

Process engineering focuses on the design, operation and maintenance of chemical and material manufacturing processes. The figure below shows how process engineers work closely together with product engineers and production planners over the entire ramp-up phase of a new product.

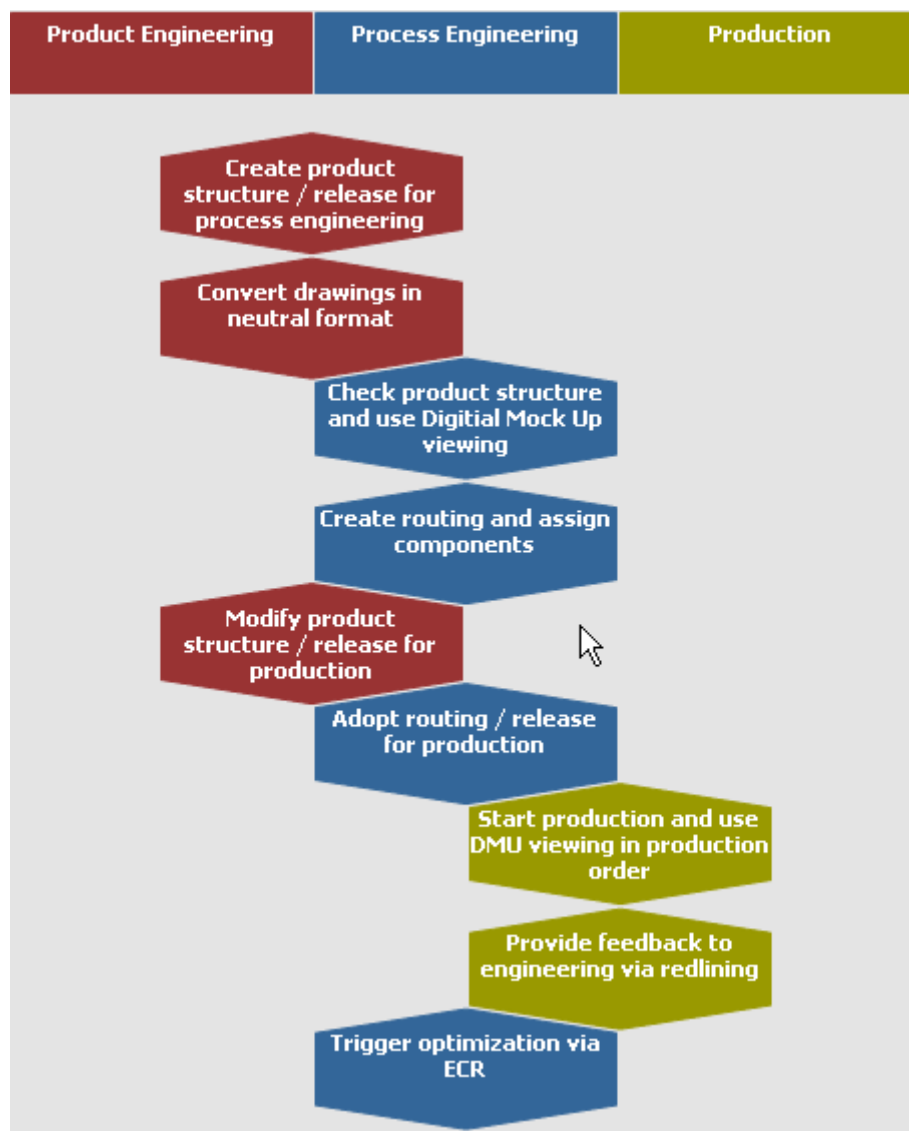


Figure 18: Process engineering

Process description

As soon as an initial version of the product structure is set up, the initial routing is being set up. Once production can be started, documents assigned to the product and process structure are provided, enabling collaborative processes during the ramp-up phase of a new product.

After the new product development process has reached its final phase a fast transition to production is essential for successful ramp up and product introduction. At this time, efficient process engineering is key and requires tight collaboration between process engineering and production.

Process engineering is supported by the engineering workbench, which allows the parallel processing of several bills of material and routings and digital mock-up (DMU) viewing. Later on, the assignment of components to specific operations allows precise procurement.

Production is started as soon as product structures and process structures are released for production. All teams involved in production have direct access to all documents needed to produce and assemble the product. Having access to these documents, production is enabled to provide feedback if things need to be optimized or changed to improve production processes. This

input then can be used by engineering to trigger engineering change management (ECM). With ECM, all objects affected by a change can be modified in one controlled process.

Value proposition

Again, by tracking the product status during its use and disposal, PEID technology might improve the process engineering process with regard to “reconfiguring the production system”, enabling the decision maker to decide upon the best configuration for a production system. The data might be used to modify product features as required by predictive maintenance or EOL processing. Once, the modifications have been decided, it is essential to adapt and reconfigure the production systems accordingly. Nowadays, the reconfiguration of production systems is taken without taking into consideration the different product or process modifications. This is mainly caused by the unavailability of proper data required for analysis and might be improved by PEID technology.

4.14.2.4 Architecture of value creation

In order to generate value supported by PEID technology, SAP plans to improve both its technological platform NetWeaver to support communication with a large variety of PEIDs and to improve its Product Lifecycle Management solution mySAP PLM to support dedicated PEID-enabled processes.

Currently, SAP’s support for PEIDs is limited to RFID technology. This is reflected in the supported processes (e.g. packing / unpacking) and in the limited device integration (with focus on RFID readers). Moreover, current processes focus on intra-company supply chains. It is our goal to develop in PROMISE concepts for extending the Auto-ID solution to:

- Include processes that cross organizational borders, e.g. to address RFID-enabled cross-company supply chains. In this context peer-to-peer technologies for data exchange among the supply chain partners are an interesting option that SAP will evaluate.
- Address integration with a larger class of devices including networked embedded systems on cars, trucks, locomotives etc. Here, the UPnP-based interfaces developed in PROMISE will provide a rather useful device abstraction.
- Incorporate generic middleware services for PLM, SCM and other applications. These services should be provided by a real-world awareness component, which should become part of SAP’s NetWeaver platform.

mySAP PLM is part of the mySAP Business Suite and provides best-of-breed functionality, plus industry-specific features and support for best practices to improve the customer’s product life cycles management processes. mySAP PLM enables companies to get the right product to market at the right time, at the right cost - resulting in increased profitability and competitive advantage (Hartmann et al. 2005). The system provides a holistic view of product-related business processes and information throughout the complete product and asset life cycle and throughout the extended supply chain. This applies from product conception, design, and engineering, through production ramp-up and product change management, to service and maintenance. The system comprises tools and processes that enable collaborative engineering, customized product development, and project management among multiple business partners.

4.14.2.5 Revenue model

Referring to SAP’s business model (see section 0) SAP generates a considerable amount of its revenue with software licenses. With the results of PROMISE SAP might be enabled to expand its mySAP PLM or the SAP Service and Asset management solution and attract further customers. Currently, SAP addresses with the solutions mentioned above major market segments such as the automotive industry, the aerospace and defence sector, the transportation sector, logistic service providers, or the oil and gas industry. These industries have - according to Gartner - a growing interest and investment in PLM. Moreover, it is important for SAP to generate further licences for SAP NetWeaver as such licences trigger further businesses with SAP application software. Due to the high interest in SAP’s Auto-ID component, SAP was able

win further SAP NetWeaver customers by selling Auto-ID in a packaged solution together with SAP NetWeaver. It is likely that SAP will follow this strategy also with an improved Auto-ID solution that includes integration with PEIDs.

4.14.3 Corresponding market view

Given its importance to product strategy and execution and today's level of software investment PLM has become (after ERP, SCM and CRM) the fourth major class of enterprise wide business applications [Gartner 2005]. Especially, the automotive, aerospace and heavy machinery industries have the deepest influence on PLM evolution. As the earliest and largest investors in mechanical design and product data management software, they are the largest PLM investors. Given their complex products, extensive and complex supply chains, and intense competition in their markets, these industries need software that can increase the speed and reduce the effort of managing product development and product data. A further growing interest and investment in PLM is also seen among high-tech, consumer goods producers and life sciences companies. According to Gartner [Gartner 2005], especially manufacturers demand benefits such as:

- Enabling not just product innovation but process innovation applied to improving corporate performance at executing the various stages of product life cycles
- Enabling a customer, service and market feedback loop to product strategy and development through business intelligence and analytics to improve product quality, supplier management, product portfolio management and compliance

Comparing these requirements with the experiences gained especially within the PROMISE industry end user case studies implementing PEID technology to dedicated PLM processes clearly adds value to the end users' value chain. Against that background, SAP recognizes major benefits such as:

- Enabling the customer to manage the entire product lifecycle and improve process innovation throughout the entire product lifecycle
- Enabling the customer to include customer, service and market feedback by tracing and updating product information after its delivery to the customer and up to its final destiny and back to the producer

that might be addressed by PEID-enabling dedicated processes within mySAP PLM and the SAP Service and Asset management solution.

Taking a closer look into the market of Enterprise Asset Management, the AberdeenGroup confirms that "companies in field service and asset-intensive industries have recognized that optimized asset management is imperative to achieve production, revenue, profitability, and customer satisfaction objectives" [AberdeenGroup]. However, asset management has never been more challenging for organizations than today: Aging assets, tougher regulatory compliance and increasing security requirements are driving up costs while budgets are continuously being cut.

Against that background, today's business forces require new and expanded technology solutions for asset and field service management. This becomes true regardless of whether the end-user enterprise, the original equipment manufacturer (OEM), or a third-party service provider is responsible for maintaining, repairing, and disposing of the physical asset. These forces include the need for greater workforce productivity due to cost and competitive pressures, the need for integrated business processes to stay competitive and satisfy customers, the need to comply with company- and industry-mandated standards, and the need to strike a cost-effective balance between leveraging existing technology investments and new solutions [AberdeenGroup].

Referring to the estimated market size of Enterprise Asset Management, ARC experts estimate that maintenance costs in asset intensive industries have risen an average of 10% to 15% per year since 1979 and represent 20-40% of operating costs. Up to one-third of the nearly \$1 trillion spent annually for maintenance may be unnecessary. However, reducing these costs, meet tougher performance and production targets, comply with increased regulatory requirements, and maximize return on assets can only be achieved by optimizing business processes throughout the asset life cycle. By constantly optimizing the appropriate solutions SAP enables its customers to

address these challenges and expects to provide its customers with competitive advantage and gain further market share.

4.14.4 References

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4.15 SINTEF

The SINTEF Group (The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (NTH)) is the largest independent research organisation in Scandinavia. SINTEF has approximately 2000 employees, 1400 of which are located in Trondheim and 500 in Oslo. SINTEF has offices in Bergen, Stavanger and Ålesund, in addition to offices in Houston, Texas (USA), Skopje (Republic of Macedonia), Warsaw (Poland) and a laboratory in Hirtshals (Denmark). SINTEF is a private non-profit foundation with close relations to academic institutions:

- The Norwegian University of Science and Technology, NTNU (NTH):
20000 full-time students and 973 scientific employees
- University of Oslo, UiO, Faculty of mathematics and natural sciences:
4500 full-time students and 518 scientific employees

By working on a wide range of projects, SINTEF is aiming to realise the vision of “Technology for a better society” by generating new knowledge and solutions for customers in a wide range of industries. This is based on research and development in technology, the natural sciences, medicine and the social sciences.

4.15.1 SINTEF’s business model

SINTEF solves customers’ problems through research contracts in the following fields: Health, information and communications technology, marine activities, materials science and applied chemistry, petroleum and energy, technology management and building/construction. SINTEF intends in this way to act as a driving force in the process of restructuring and developing the Norwegian society.

In order to ensure that this research is available to society as a whole, SINTEF also operate units whose principal activity is action research. The organization is also active in testing and certification in a number of areas, not only within the SINTEF Group itself, but also through companies in which SINTEF is shareholder and via cooperation with other organisations. These activities make significant contributions to creating added value from the knowledge and solutions produced by SINTEF’s researchers. SINTEF wish to be of use to both small and large companies. The SINTEF Group is structured into several research divisions, which have been defined in terms of value chains and industrial market clusters:

- SINTEF Building and Infrastructure
- SINTEF Health Research
- SINTEF ICT
- SINTEF Marine(MARINTEK and SINTEF Fishery and Aquaculture)
- SINTEF Materials and Chemistry
- SINTEF Petroleum and Energy
- SINTEF Technology and Society

The PROMISE project is coordinated by SINTEF Technology and Society. This division develops new knowledge and technology to add value on company and society level. This is done through a wide range of scientific methods, analyses, tests/simulations and development of products and services. Typical areas where most businesses request new knowledge and technology are:

- Productivity and innovation ability;
- Change processes;
- Knowledge management;
- Logistics;
- Manufacturing;
- Working environment;

- Safety and environmental management;
- Economic decision models;

The division performs R&D and consulting services contributing to added value, safety and a good environment. Based on a holistic understanding of technological, economical and organisational factors SINTEF applies generic knowledge within all types of industrial and service related businesses, as well as branch specific knowledge related to the transportation water and waste industries

4.15.1.1 Technology (incl. knowledge) transfer into SINTEF

The technology and knowledge transfer into SINTEF is mainly based on participating in projects initiated in cooperation with industry and other academic partners. SINTEF's portfolio of projects is to a large extent defined by its sources of finance. This is illustrated in Figure 19.

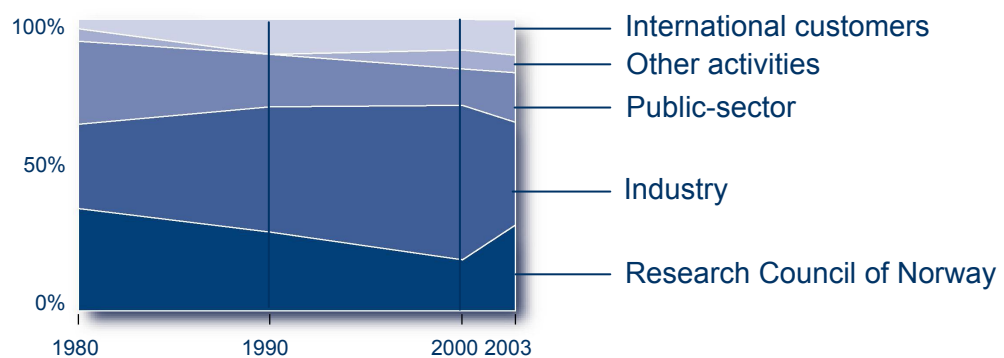


Figure 19: The SINTEF Foundation's sSINTEF'sces of finance

The basic funding of SINTEF is very small (3%) so even if SINTEF is a non-profit organization the organization is operating in a competitive market for all relevant types of R&D projects:

- EU-projects: competing on participation and funding in attractive programs;
- RCN-projects: competing on participation and funding;
- Industry funded projects: competing with consultancy firms etc.;
- University partnership and programs: competing with other R&D organisations and consultancy firms on partnership etc.

Approximately 70% of SINTEF's projects are related to industrial customers. Projects funded by the Research Council of Norway (RCN) is very important for SINTEF.

4.15.1.2 Example of a general business model

The figure below illustrates how SINTEF from working with industrial partners and customers often sees issues and challenges of common interest which might initiate a process heading for larger R&D projects.

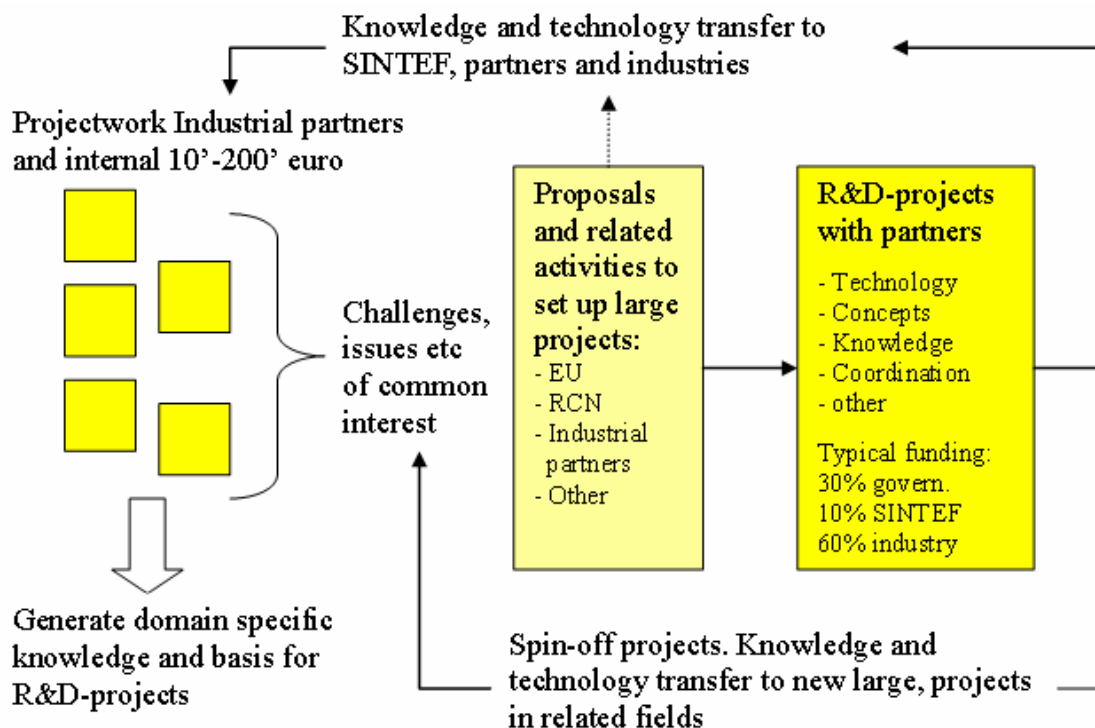


Figure 20: A general business model

The results from the projects are knowledge, concepts, technology etc which could be a basis for new large R&D-projects or input to new projects and generate a positive (often economical) impact for customers and other partners as well as for SINTEF itself.

4.15.2 Description of new business models

In SINTEF the value in R&D projects like PROMISE is to generate and harvest knowledge in as many aspects of RFID and life-cycle issues as possible. This ranges from technology- to management-, strategy- and organizational aspects.

SINTEF is focusing on transfer of this knowledge to academic and industrial partners. SINTEF is also focusing on distribution of this knowledge internally in SINTEF and enabling development into new fields of R&D.

The value creation is to a large extent represented by getting new projects and getting acceptance for knowledge through dissemination activities. In the long term value creation is also related to the strengthening of RFID- and supply chain research communities in SINTEF and academic partners.

▪ Objective 1.1: 2 new consortium based R&D projects funded by RCN

Work on one proposal has started (PROMISE Norway), 6 industrial partners have been contacted. The project will focus on technological aspects and knowledge management etc from PROMISE, but will have an extended focus on performance management. Positive feedback from them has resulted in work towards preparing a RCN application. Duration of 4 year, preliminary budgets 350.000 euro. Possible projects related to EOL in the leisure boat industry will be discussed with relevant partners in April-May 2006.

▪ Objective 1.2: 6 new industry (funded) projects

By working on setting up PROMISE Norway several project ideas have been identified. These are projects focusing on issues of special interest for one (or a smaller group) of companies/

organisations. 2 project ideas related to hospitals have been identified (Management of critical equipment and decision support systems). Budget 1st phase app. 2* 40.000 euro. Possible projects related to the automotive industry have also been identified. This is projects where findings/solutions from the PROMISE are of direct relevance.

- **Objective 2.1: Dissemination**

SINTEF dissemination activities will be closely related to PROMISE-dissemination strategies. SINTEF's own (not PROMISE dissemination) objective reviewed articles/papers: 10

- **Objective 2.2: Research community**

SINTEF considers PEIDs (RFID, sensors etc) and supply chain management as an important research domain. This has among other priorities resulted in establishing of the SINTEF RFID-lab in Oslo. A strengthening and transfer of PROMISE-knowledge into these areas is regarded as an important value creation for SINTEF.

Other industries have also shown interest for PROMIS-technology/knowledge. The Norwegian automotive industry and leisure boat industries have been mentioned before. The latter (boat-manufacturing) represent a turnover of more than 300 millions Euro.

4.15.2.1 Revenue model

SINTEF's Revenue model is basically described in the figures shown in this chapter. SINTEF is a non-profit organization, but depended on income from projects, normally in competition with other R&D-institutions. The projects often have a split funding as illustrated in the figure illustrating the PEMRO-project.

As SINTEF is normally not implementing solutions, selling products etc, SINTEF's Revenue model is not based on calculations of impact for customers of SINTEF's contributions. SINTEF's Revenue model is based on a market apprehension of SINTEF's competence as credible and relevant for industry-, academic- and funding partners. SINTEF's Revenue model will therefore differ drastically from e.g. an industrial partner or a software provider in the PROMISE project.

4.15.3 Corresponding market view

As a non-profit research organization SINTEF is normally not competing in the market for implementation of solutions. SINTEF is a knowledge provider and often developing prototypes that might become relevant solutions in the market. With this in mind SINTEF will normally have difficulties in quantifying market sizes etc. But SINTEF consider PROMISE technology/knowledge as relevant for the majority of the industries SINTEF is operating in. This is exemplified below:

- **Fishery and other food industries**

The need for better systems for tracking and food safety has been highly emphasised due to possible contamination problems, and e.g. export disagreements. Norwegian vessels delivered 2.4 million tonnes of fish in 2005, and a landed value amounted to 1.4 billion euro. 80% export.

- **The oil and gas industry**

The oil and gas industry employed around 29.000 people in 2004. The gross value of production in the Norwegian oil and gas industry, including pipeline transport, amounted to 55 billion euro in 2004. PEID-technology is relevant in BOL, MOL and EOL – but in rough off-shore conditions maintenance-related issues, HSE (Health Security and Environment) is of special “PROMISE relevance”.

- **The hospital sector**

The hospital sector has certain needs regarding resource management where PROMISE technology and knowledge is relevant. The hospital sector has 36 somatic hospitals (public) of which 7 are university hospitals. 63 155 persons are employed in the hospital sector in Norway.

4.16 Stockway Oy

Stockway delivers Trackway Solutions which help organizations optimize their value chains with real-time business information delivery. Founded in 2001, Stockway has extensive experience in creating value for its customers by offering turn-key business process optimization and advanced RFID-based solutions.

Stockway's operations are driven by customer satisfaction. Processes are flexible, efficient and cost-efficient

The research and development process of Stockway is based on its core values: reliability, efficiency and flexibility. Stockway PROMISEs its customers the benefits from the "Power of knowing now" and expects no less from its internal processes.

4.16.1 Stockway's business model

Stockway offers its customers standard software solutions that can be readily tailored to suit individual needs.

In addition Stockway provides comprehensive professional services that range from support and application development to total OEM software solution development.

Stockway's software is technology independent but the company has developed particular expertise in RFID and the application areas surrounding automatic component and product identification. Trackway manages the relationships that exist or existed between unique components and their position in space and time. By virtue of a peer to peer networking methodology, Trackway allows geographically distributed information to be linked to unique items and manages information delivery to known players in the value chain (nodes). Trackway is an implementation of the WWAI (World Wide Article Information) protocol.

Stockway is predominantly present in the following vertical business segments:

- Supply chain management
- Manufacturing
- Healthcare
- Asset management

Revenue is generated through sales of software licenses and professional services.

4.16.2 Description of new business models

Stockway has identified the following business opportunity through PROMISE:

- "Total Product Lifecycle Management information delivery"

As described above, Trackway software acts as the network in linking geographically distributed information to unique items. It does this securely and cost effectively.

The strength of PROMISE is to close the loop in data gathering and making this data available to authorised parties for transformation into knowledge, which is in turn delivered to enable it to be transferred into actionable instructions.

Stockway is able to fulfil and deliver a critical part of this ambition.

Stockway is investigating the implications of opening up and making available its WWAI protocol to PROMISE consortium and other partners. By removing the proprietary nature this will enable rapid proliferation and permit acceptance as a standard also within the EPCglobal framework. The Trackway engine is available to partners as the prime implementation of this standard.

Business model 1 -Technology Supplier

Product focus:

- Development of PROMISE information delivery software components providing integrated PROMISE functionalities

Target markets:

- PROMISE partners
- External partners

Business model 2 -Software Supplier

Product focus:

- Development of stand alone PROMISE software able to deliver part of the PROMISE methodology which can be integrated to other PROMISE compliant systems.

Target markets:

- Manufacturing industry

Business model 3 – Services

Product focus:

- Consulting partner companies that need education for the implementation of PROMISE concepts and products.
- Systems integration of PROMISE solutions.

Target markets:

- Manufacturing and service industries
- Stockway partners

4.16.2.1 Value proposition

Stockway's compelling value proposition within the PROMISE context is that Trackway software is able to deliver the PROMISE vision by enabling the delivery of all critical product lifecycle information from anywhere to anywhere in a secure manner.

4.16.2.2 Architecture of value creation

Trackway software will create value and improve competitive advantage as the WWAI peer-to-peer networking infrastructure offers the most cost effective solution to “sharing” information and information delivery. It renders possible and compliments the already significant value that PROMISE will deliver to the end client with significant impacts on cost of ownership and the environment.

4.16.2.3 Revenue model

Revenue is generated through sales of software licenses, OEM development and professional services.

5 Impact on SMEs

“Midsize companies are nothing if not growth oriented. While some are spin-offs from big organisations, many more started life as small firms that have grown organically or through merger into larger entities. Some will continue along the path to become truly large enterprises, although by no means all aspire to this.” [Economist Intelligence Unit]

Midsize firms are – per definition of the Department of Trade and Industry – companies having between 50 and 249 employees. Smaller companies employ less than 50 employees. In many countries SMEs (Small and Medium-sized Enterprises) are an important engine of economic growth, especially in Europe. To give some numbers:

- Firms earning between US\$30m and US\$500m represent 1% of all US companies, while generating nearly 30% of corporate revenue.
- Midsize businesses are only 2% of UK firms but employ 14% of the work force and generate 16% of turnover.

For SMEs, globalisation turned out to be a double-edged sword: On the one side, it creates stiffer competition and pressure on prices, while at the same time; it also provides new opportunities for growth. And – referring to the quotation above - SMEs have an enormous need to grow. However, they currently find themselves squeezed by the effects of an increasingly tough global competitive environment, namely downward pressure on prices, rising input costs and consolidation. With regard to the impact PROMISE gains on SMEs, we recognize the following broad variety of benefits:

- **Broaden their product portfolio**

The SMEs participating in this project took the chance to further enhance their product portfolio. By offering a broader range of products or enhanced functionality they stay competitive, ensure revenue, and eventually expand their opportunities for growth.

- **Maintain their existing client base and target new customer segments**

As outlined by ENOTRAC in section 4.5, SMEs need to maintain their existing client base. Competency must be continually developed in line with changing technologies to stay competitive. In addition, by broadening their product portfolio SMEs are enabled to target new customer segments in order to generate new revenue.

- **Licensing agreement**

A very common approach in today's economy refers to the licensing model: In case, the appropriate SME does not possess the range of resources required for an adequate commercialization it may initially develop the new technology and then license it to a larger concern.

- **Service offerings**

Once, PEID technology has further evolved especially the participating SMEs in PROMISE are able to provide their customers with consulting or implementation service offerings.

- **Partnering and jointly benefiting from synergies**

Projects such as PROMISE offer a great potential to build up strong partnerships with the companies involved in the project. They even might last for the time after the end of project and provide synergies in future. Furthermore, partners play a key role in SAP's company strategy. Against that background, SAP recognizes the vital role its partners play and offers its partners different partnership categories for every strategic business area and customer need. SMEs joining the SAP partner ecosystem reap significant benefits through their association with SAP, which provides a greater market exposure, expanded business opportunities, joint strategic sales and marketing initiatives, or access to a broad and growing customer base.

Reference

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6 Conclusion

With this document we presented the business opportunities and the market perspectives explored in PROMISE during the first eighteen project months. One can identify a broad variety of potential business opportunities. They can be classified according to the following categories:

- Process improvements
- Development of new products and interfaces
- Functional enhancement of existing software products
- PEID-based service offerings

The document's "highlight" is the business model description of CRF, developing a business model for IVECO based on A4: The IVECO-PROMISE DSS for Fleet Management (IPDFM). In a detailed technology benchmarking and a Quadrant Analysis (see annex), it is being demonstrated that the IPDFM is to date among the winning approaches in terms of perceived value/quality, with respect to a basket of worldwide competitors.

To deal with partners who have not been able to contribute their business model description at month 18 (e.g. as they do not have resources allocated to exploitation) we propose the following process: New business opportunities descriptions will be added to the WP I3 PROMISE eRoom folder, as soon as they become available. Regular updates on the advancements will be presented in the rolling reports (updates of DI3.1 are not planned in accordance with the PROMISE DoW).

7 Annex: The IVECO Business Model in A4

Revision History

Date (dd.mm.yyyy)	Version	Author	Comments
12.01.2006	0.1	J.Mascolo	Structure
17.03.2006	0.2	J.Mascolo, N. Francane, M. Francano	Competition analysis, OEM market
20.03.2006	0.3	J.Mascolo, N. Francane, M. Francano	+ Introduction
02.05.2006	0.4	J.Mascolo, N. Francane, M. Francano, G. Iacoviello	+ users requirements and fleet management systems
05.05.2006	0.5	J.Mascolo, N. Francane, M. Francano, G. Iacoviello	Refinements
09.05.2006	1.0	J.Mascolo, N. Francane, M. Francano, G. Iacoviello	Final version

Abbreviations

Abbreviations used in this document:

CRM	Customer Relation Management
DSS	Decision Support System
ELV	End Of Life Vehicles
EOL	End Of Life
FMS	Fleet Maintenance Systems
IPFMS	IVECO-PROMISE DSS for Fleet Management
O.E.M.	Original Equipment Manufacturer
ROI	Return on Investment

7.1 Introduction

7.1.1 Purpose of this document

This document presents one of the Business Models for IVECO related to the application of PROMISE methodologies and tools: the support for maintenance of fleets based on predictive maintenance algorithms. In the following we will use the term “IVECO-PROMISE DSS for Fleet Management” (acronym IPFMS). The final objective of the document is to describe this business opportunities for IVECO, evaluate its strength and the potential market. Thus this document describes the OEM and fleet market, the users requirements and the competitive positioning of the tool with respect to a basket of existing commercial Fleet Management systems, some of them provided by trucks OEMs.

Finally this Business Model provides qualitative assessment of the potential business for IVECO¹.

7.1.2 Positioning of the present document in I3

This document is an Annex of the Deliverable DI3.1, which presents an overview of the business opportunities and the market perspectives explored in PROMISE during the first eighteen months of the project. It relates also to DI3.3, which presents a framework for business model definition that is available since month 18, and thus this report combines some elements of that document in the typical approach followed by IVECO and CRF for business model elicitation.

7.1.3 Document overview

This report (Annex to deliverable DI3.1), after having briefly recalled the scope of the application scenario, presents one of the Business Models for IVECO related to the application of PROMISE methodologies and tools. The term “IVECO-PROMISE DSS for Fleet Management” (acronym IPFMS) will be used throughout.

Section 7.1 introduces the objectives of the document. Section 7.3 and section 7.4 present, respectively a study of the OEM market, presenting in details the market situation of all Trucks manufacturers, and a study of the commercial vehicles fleets. After having recalled the characteristics and functionalities of the Fleet Management Systems, and in particular the Assistance and Maintenance Systems for fleets, Section 7.5 presents the “Voice of the Customer²”, i.e. the requirements expressed by the potential clients of the FMS: trucks drivers and Fleet Managers. Then section 7.8 presents the competitors of the PROMISE DSS for Fleet Management and a selection of the main systems or OEM services against which the PROMISE DSS for Fleet Management will compete. In the same section, this report describes the functionalities against which the different systems will be positioned, in the section last part.

Finally section 7.9 sketches the potential market and concludes, presenting some conclusions that can be drawn from the analysis of the business model for the IVECO-PROMISE DSS for Fleet Management.

7.2 Overview

Costs related to maintenance interventions are often higher than purchasing prices. This is true in many different branches and, in particular, in the transportation sector (see [2])

In various highly technology-based industrial branches, the development of innovative approaches for better managing the maintenance of complex machines have been deeply practised in last years: passing from approaches meant to optimise the scheduling of maintenance interventions performed on systems breakdown to historical data analysis to better foresee possible future breakdowns. In recent years **predictive maintenance methodologies** based on real-time

¹ Quantitative figures, including scenarios for sales, the analysis of the pricing schemes, analyses of sensitivity of the market with respect to price... would be the scope of a proper Business Plan. Anyhow some of these aspects will be addressed in successive documents in I3.

² In the Automotive sector, the point of view of the client.

monitoring of the actual status of the critical components are growing, especially in the machine tool area.

In the automotive sector, the maintenance of vehicle is currently still strongly based on preventive approaches and, in some cases, on system breakdowns. This may consist in an acceptable comPROMISE for private cars and vehicles. Otherwise adopting this approach for commercial vehicles (e.g.: buses, trucks, light commercial vehicles...) is unquestionably wasteful and uneconomical for its owner and a more efficient and adequate solution is desirable.

Aiming at this purpose, a Decision Support System (DSS) designed to implement a **Condition-based predictive maintenance** for commercial vehicles is the main scope of the Application Scenario A4.

Condition-based predictive maintenance introduces a new philosophy of maintenance, where components are replaced depending on the effective use of the vehicle.

A predictive maintenance approach strives to detect the onset of equipment degradation and to address the problems as they are identified. This allows casual stressors to be eliminated or controlled, prior to any significant deterioration in the physical state of the component or equipment. This leads to both current and future functional capabilities.

Considering this application as starting point, creative sessions were held within the Fiat Group sectors to allow the identification of all the relevant business improvements or new businesses potentially deriving from findings of the A4 Application Scenario.

Building on this, CRF has developed a business model for the IVECO new business enabled by the PROMISE Technologies. In this document we will study what we call the IVECO-PROMISE DSS for Fleet Management (IPDFM). We present a study of the Trucks manufacturers (OEM) market and of the potential clients: the commercial vehicles fleets. The characteristics and functionalities of the Fleet Management Systems, and in particular the Assistance and Maintenance Systems for fleets, are presented along the requirements expressed by the potential clients of the FMS: trucks drivers and Fleet Managers. We then present the competitive advantages and competitive positioning of the PROMISE DSS for Fleet Management with respect to existing commercial solutions.

In conclusion we highlight the competitive advantages of the IPDFM with respect to the competitors, providing an essential tool for driving the development of the DSS in A4.

7.3 Overview of the OEM market

In the first six months of the 2004 ([3]), global sales of commercial vehicles rose by 8 percent compared to the same period last year, thanks to a combination of new products and technologies, improvements in cost structure, customer-oriented services and an increase in global manufacturing and market presence:

- Truck sales in the NAFTA region rose by more than 30 percent, with heavy-duty, class- 8 trucks up by almost 40 percent.
- Truck sales in Brazil and Argentina also rose by 40 percent.
- Sales rose by 20 percent in China, which is now a larger market for commercial vehicles than Western Europe and the U.S. combined.
- In Western Europe sales of medium-duty vehicles rose by 8 percent while sales of heavy-duty vehicles were up by 5 percent. However, not all the markets of Western Europe are developing at the same pace, and demand is still particularly sluggish in France and Italy.
- In the new EU member states, sales increased by 25 percent.

7.3.1 European light commercial demand and forecast

In Europe, the light commercial vehicle market is characterized by smaller numbers in comparison to the European passenger cars market, in the ratio of 1 to 8. Figure 21 shows that, in 2004, about 1.8 million light commercial vehicles have been registered in Western Europe. France, with more than 400,000 registrations, is the first market followed by United Kingdom, Germany, Spain and Italy. The five major markets by themselves account for nearly 77% of new European registered light commercial vehicles (1,435,000 units). Western Europe future trends show light commercial vehicles market will not change significantly during time approaching 1.9 million units in 2013 (+1% compared to 2004). Table 2 shows the trend of total and light commercial vehicles demand in Western Europe, divided per segment (see Appendix). In 2004, two segments represented more than half of all registered light commercial vehicles followed by 1B, 1A and PU segments (respectively with 23%, 16% and 6%).

EUROPE TOTAL LCV DEMAND						FORECAST									
U/000	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Italy	220	207	245	203	210	205	210	215	220	225	225	225	220	220	
Germany	273	262	251	243	256	250	255	250	250	255	260	270	275	275	
France	418	437	409	387	415	385	390	400	410	420	420	420	420	420	
United Kingdom	233	247	257	296	321	275	280	280	285	280	280	285	285	285	
Spain	210	204	194	211	232	205	200	205	205	210	210	210	210	210	
The Netherlands	95	83	81	77	86	80	83	85	87	90	92	95	95	95	
Belgium & Lux	55	61	52	54	56	57	56	58	57	60	61	62	62	62	
Switzerland	27	28	25	22	23	22	24	25	24	23	25	26	27	28	
Portugal	120	98	78	65	68	75	78	80	85	90	95	95	95	95	
Ireland	35	33	30	26	25	28	30	31	29	28	29	31	32	33	
Greece	23	20	19	18	23	19	21	21	22	21	22	22	23	23	
Denmark	29	28	28	26	38	28	31	32	31	30	31	31	32	32	
Austria	32	29	27	29	33	29	29	30	31	31	32	33	33	33	
Sweden	33	30	30	29	32	29	30	29	29	30	30	31	32	32	
Finland	15	15	15	17	20	16	16	16	17	17	17	17	17	17	
Norway	24	26	21	22	27	22	22	22	23	23	24	24	24	24	
Western Europe	1,843	1,808	1,762	1,728	1,866	1,723	1,755	1,779	1,804	1,833	1,853	1,877	1,882	1,883	
Poland	44	28	25	30	36	31	33	34	35	36	37	37	38	38	
Czech Republic	15	15	14	16	26	16	17	18	19	19	19	20	20	20	
Slovakia	6	6	6	6	9	6	6	6	6	7	7	7	7	7	
Hungary	26	25	29	24	24	28	29	30	30	30	31	31	31	31	
Slovenia	4	4	4	5	5	4	4	4	4	5	5	5	5	5	
Total Europe 21 countries	1,937	1,886	1,840	1,808	1,965	1,808	1,844	1,871	1,898	1,929	1,950	1,976	1,982	1,983	

Figure 21: European light commercial vehicles demand up to 2013 per country (source:CRF)

LCV

WESTERN EUROPE

TOTAL LCV DEMAND PER SEGMENT

U/000	2000	2001	2002	2003	2004	FORECAST								
						2005	2006	2007	2008	2009	2010	2011	2012	2013
Segment PU	115	86	91	98	106	97	99	99	101	101	102	104	105	105
(%)	6,2	4,8	5,2	5,7	5,7	5,6	5,6	5,6	5,6	5,5	5,5	5,5	5,6	5,6
Segment 1A	269	251	246	222	242	228	232	237	242	247	249	250	250	250
(%)	14,6	13,9	13,9	12,8	13,0	13,2	13,2	13,3	13,4	13,5	13,4	13,3	13,3	13,3
Segment 1B	449	465	438	458	482	457	465	474	481	490	494	499	500	500
(%)	24,4	25,7	24,8	26,5	25,8	26,5	26,5	26,6	26,7	26,7	26,7	26,6	26,6	26,6
Segment 2	1.010	1.006	988	950	1.035	941	960	969	981	996	1.007	1.024	1.028	1.029
(%)	54,8	55,6	56,1	55,0	55,5	54,6	54,7	54,5	54,4	54,3	54,4	54,6	54,6	54,6
TOTAL W. EUROPE	1.843	1.808	1.762	1.728	1.866	1.723	1.755	1.779	1.804	1.833	1.853	1.877	1.882	1.883

Table 2: Western Europe total LCV demand up to 2013 per segment (source: CRF)

With regard to light commercial vehicles, the main point to be observed is that six groups (Fiat/Iveco, VW, PSA, RENAULT, Ford) represent about 72 % of the total market (see Figure below, and Annex). The FIAT Group is represented both by FIAT (Light Commercial Vehicles branded FIAT) and IVECO.

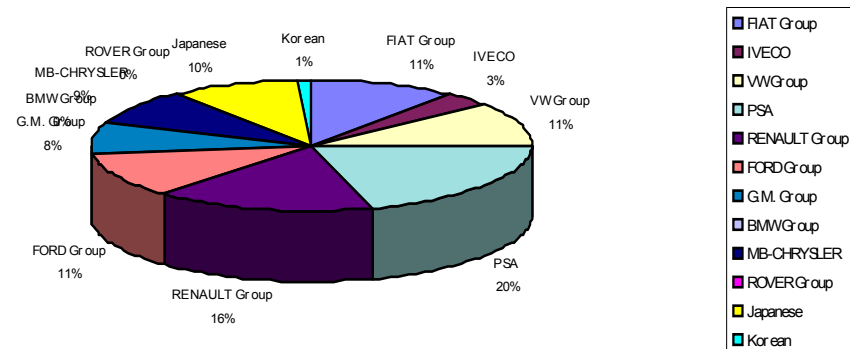


Figure 22: Western Europe total Group LCV sales (source:CRF)

7.3.2 European trucks and buses market

The truck business is highly cyclical. After record sales in the late 1990s, no one should have really been surprised that things dropped off in each of the past two years. Further decline during 2002 will bring West European medium and heavy vehicle sales to a level that is 12% to 14% below that of the previous year. This was sharper than the industry would have liked but was not totally unexpected and was certainly not close to the magnitude of the fall experienced by the sector in North America. In 2004 the production of diesel buses was 18,626 units. Figure 23 shows the medium and heavy commercial vehicle demand trend during latest years.

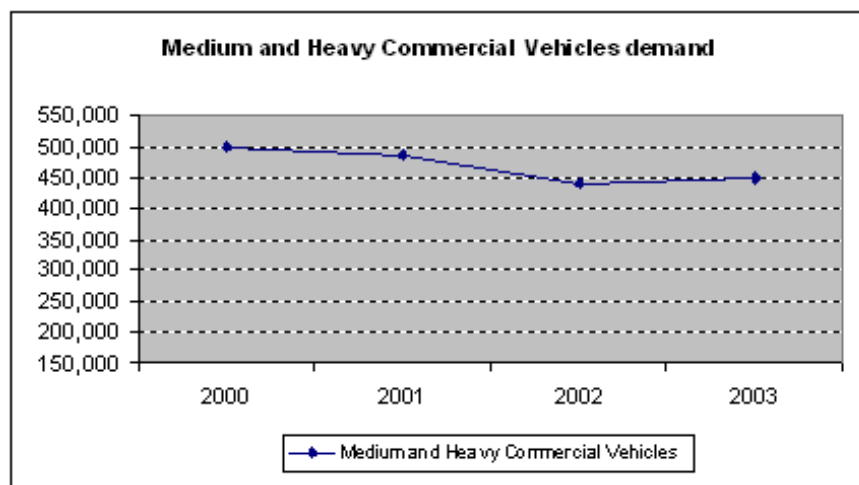


Figure 23: European medium and heavy commercial vehicle demand, source: Diesel Progress North American Edition December 2002

7.3.3 USA light truck market

Even though the American passenger car and light truck market is still the first in the world numerically, during latest years overall sales have been decreased with an imperceptible growth in 2004. As shown in Figure 24, car sales have always decreased during last five years whereas light truck sales have always increased. The passenger car sale decreasing is due to the big three decline, while all the other manufacturers stay steady or grow. On the contrary, the light truck increase is due to the extra U.S. manufacturers growth, whereas big three sales are flat. In the Figure below is also exposed the 2004 American sales of passenger cars and light trucks by

vehicle category: continuous and strong growth belongs to CUV (Crossover Utility Vehicles) while sales of SUVs and luxury cars have collapsed and Van decline has ended.

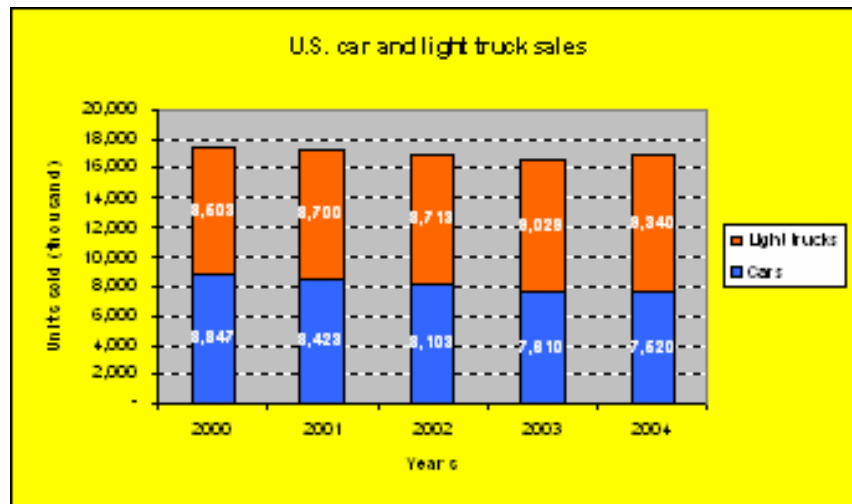


Figure 24: American cars and truck sales from 2000 to 2004,

7.3.4 Us truck sales and market share

Sales of trucks have grown from 2001 to 2005. Table 3 below shows the evolution of of Medium and Heavy sales in the US during the last five years.

	Medium Truck	Heavy Truck
2001	288.578	128.260
2002	214.410	165.456
2003	201.581	158.748
2004	226.496	194.827
2005	237.173	253.828

Table 3: Medium and Heavy truck sales (2001-2005)
(source: CRF elaboration on Wards Auto Data)

7.3.5 Summary Worldwide Commercial Vehicle production

The Table 4 below shows the total commercial vehicles world-wide production. In 2004 was nearly 18 million units, 11.2% up with respect to 2003.

Nafta Region	
Light Commercial Vehicle	8.512.246
Heavy and Medium Commercial Vehicles	343.252
Buses	29.033
total	8.884.531
Mercosur Region	
Light Commercial Vehicle	378.005
Heavy and Medium Commercial Vehicles	95.235
Buses	29.279
total	502.519
Eu Region	
Light Commercial Vehicle	1.947.106
Heavy and Medium Commercial Vehicles	439.336
Buses	18.626
total	1.947.106
EE Region	
Light Commercial Vehicle	401.774
Heavy and Medium Commercial Vehicles	63.571
Buses	25.709
total	491.054
Asia-Pacific Region	
Light Commercial Vehicle	4.361.021
Heavy and Medium Commercial Vehicles	778.873
Buses	104.998
total	5.244.892
Total Worldwide	17.706.295

Table 4: Total CV Global production in 2004
(source: CRF elaboration on Frost & Sullivan Data)

The conclusions to be drawn is that a positive trend can be seen worldwide, and in particular in the most mature markets (the US and, in Europe, Great-Britain), where the Fleet Management is also a more mature business, which will be presented in the next chapter.

7.4 Overview of the Trucks Fleet Market

The aim of this chapter is to present the main market segments for services to transportation companies in selected European Countries in terms of:

- a) service typology
- b) size of the market segments (number of transport companies)
- c) transportation companies organisation

The analysis of the fleet market will be used in further elaborations of this business model to define the potential market for the IPDFM.

In the following the information are presented separately for Italy, France, Germany and the US.

7.4.1 Road freight transport services in Italy

Road freight transport services in Italy contribute more than 90 % of the overall transport operations. The effects induced by the development of the logistics activities (the fragmentation of the deliveries, the reduction of the dimension of the lots, the increase of the average number of items and the greatest rapidity of the service) also contribute to the development of road transport on medium and long distances.

Some specific critical "structural conditions" are present In Italy, for which the problems of the road freight transport continue to represent a structural factor that is destined to stay such in the next decade³:

- the geographical configuration of the country
- the population and the companies dispersion on the territory

³ See also [5].

- the low average dimension of the companies
- the fragmentation of the companies
- the diffused practice of the outsourcing
- the high importance of the retail.

Considering only the Italian operators, excluding the urban distribution and the vehicles with GVW lower than 3,5 tons, over than 1,2 billion tons of goods have been moved by road in 2000⁴.

In this respect, figures show a stable situation in transportation showing that small transporters still represent roughly 15 % of the total transported goods. The table below presents the dimensional distribution (number of vehicles) of the Italian companies which operate in the field of "third party" transport. The table refers only to the companies with at least one vehicle having "net load" over than 11,5 tons (normally corresponding to companies that offer medium – long distance services).

Dimension (vehicles number)	Total vehicles (by census)	Average number of vehicles per company (hypothesis)	Number of companies (hypothesis)	Percentage on the total (%)
1 – 2	40521	1.1	36837	64,5
3 – 5	38394	3.2	11998	21,0
6 –10	27645	6.5	4293	7,5
11 – 20	24395	12,0	2033	3,6
> 20	42557	22,0	1934	3,4
Total	173512	3,0	57095	100

Table 5: Distribution of third party transporters (Italy)

Table 6 below represents the number of companies and employees (by employees classes) for the road freight transport segment in 1998 in Italy . It shows the percentage distribution of the companies by classes of employees. The main points out the table and Figure 25 show the fragmentation of the transportation into many small transporters, with few drivers and trucks:

- the companies were altogether around 111400
- the employees were altogether around 270000, with a mean of 2,4 employees per company
- more than 83 % of the companies had two or less employees.

N° of employees	Companies	Independent employees	Dependent employees	Total employees
1	76779	76779	0	76779
2	16090	25692	6488	32180
3 - 5	10822	20542	18604	39146
6 – 9	4147	8346	21843	30189
10 – 15	1750	3914	16887	20801
16 – 19	570	1429	8482	9911
20 – 49	993	2806	26055	28861
50 – 99	180	457	11868	12325
100 – 199	57	71	7840	7911
200 – 249	11	11	2401	2412
250 - 499	16	17	5300	5317
500 - 999	5	5	2988	2993
1000 and over	1	1	1666	1667
Total	111421	140070	130422	270492

Table 6: Distribution of companies by number of employees (Italy)

⁴ Part of these data are the output of an European Project under the 5th Framework (COMETA, see [4])

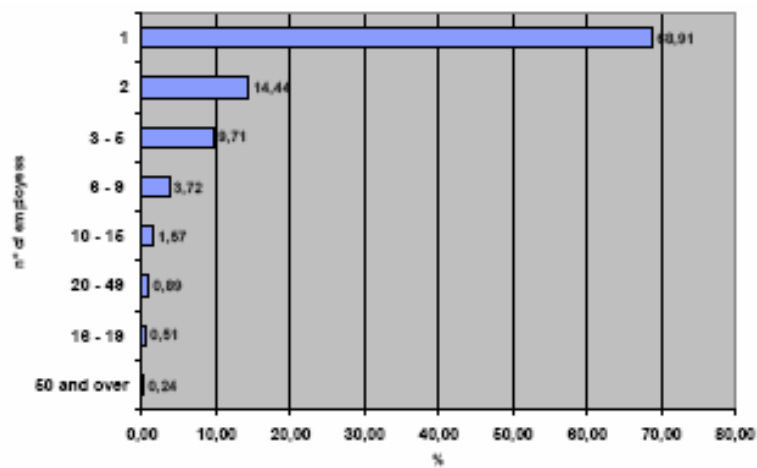


Figure 25: Road freight transport - companies by classes of employees (percentage distribution, Italy)

7.4.2 Road freight transport services in France

The following table collects some of the main indicators concerning road transports in France. From the table it appears that:

- the road transport in France is characterized by a great number of companies (about 77%) having less than 5 employees: this sector is still quite fragmented;
- the average number of employees per companies is around 7.

	Total
Numbers estimated companies from 0 to 5 employees	29366
Numbers estimated companies more than 5 employees	8789
Total number of companies in transport sector	38155
Total number of employees in transport sector	276438

Table 7: Road transports companies (France)

7.4.3 Road freight transport services in Germany

Table 8 below collects some statistical data concerning the companies being part of the "commercial goods transport on road" sector in Germany. From the table the following "indicators" can be extracted:

- average number of employees per company: about 9,5
- average number of trucks per company: about 4,5.

With respect to Italy and France, the figures indicate a major number of medium dimension companies.

Companies	40520
Employees	383325
Trucks	181389
Trailers	185265

Table 8: Road transports companies (Germany)

Table 9 summarises the distribution of companies in function of the fleet size: companies with a less than 10 trucks represent about 85 % of the total.

Size of the fleet (in trucks)	Number of companies	Percentage
1	11107	27.4
2 to 3	10460	25.8
4 to 10	12895	31.8
11 to 50	5748	14.2
51 and more	310	0.8
TOTAL	40520	100.0

Table 9: Number of companies in function of the size of the fleet

7.4.4 Road freight transport services in the U.S.

The Figure below presents an overview of the most active market in the world, which is usually considered to be 4-5 years ahead of the rest of the world, both for the truck industry, the Fleet and the Fleet Management systems. It enables to compare the evolution of the fleet sector for cars and light trucks.

In general, while the cars market is stalled, the light trucks market is still growing at a rate slightly over 10%. Entering into details into the trends, the structure of the ownership of the fleets is remarkable:

- nearly 20% of the fleets are company-owned
- more than 17% of the fleets are in leasing
- more than 60% are rented, which shows a trend which is also growing in the other more advanced market in Europe, the UK.

With respect to the evolution of the market, in fact we can recognise that the trend towards the outsourcing of the propriety of the fleet (already initiated) has continued over the last year (2003-2004⁵):

- an increase of nearly 15% of the lights trucks in leasing (with respect to an overall increase of the light truck market of 10%, as stated before)
- an increase of nearly + 16% of light trucks in rental (idem)
- a stable percentage for the other segments.

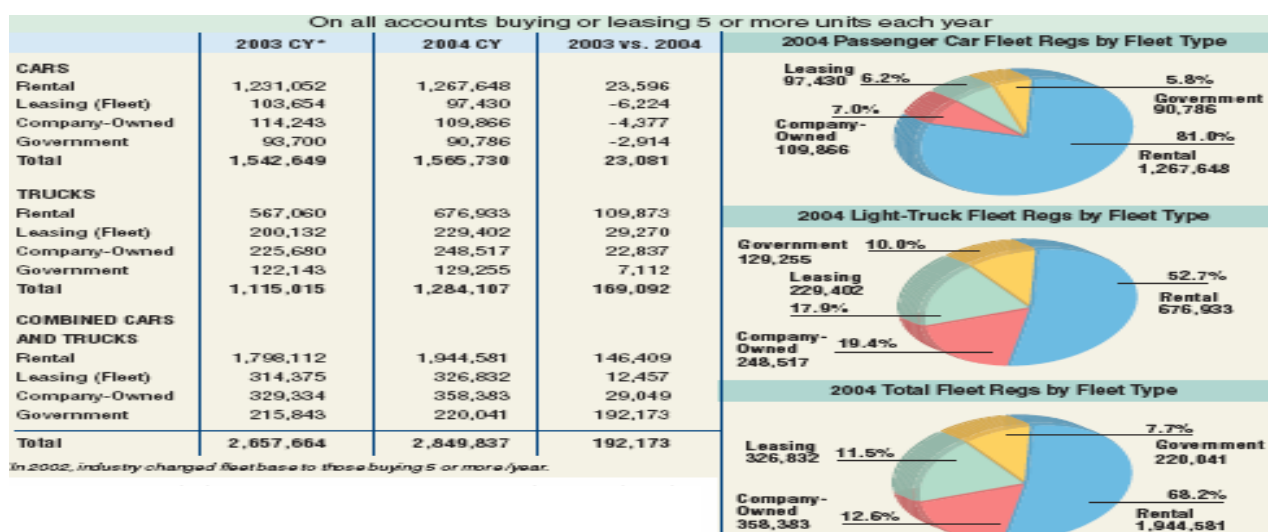


Figure 26: US New car/ truck fleet registrations (Source: Polk)

⁵ These data are the last available for the light truck segment.

The study does not specify the type of ownership for the fleets which are subsequently rented or leased to the commercial users, but in fact they can be whether the OEMs (truck manufacturers) or specialised companies (“third-party fleet owner”).

There is thus a growing number of medium to large companies (with more than 20 trucks) which are envisaging to use, or already using, advanced fleet management systems, in particular to optimise the functioning and availability of their vehicles for the commercial user. These aspects will be addressed in the following chapter.

7.5 Fleet Management Systems

In the transport marketplace monitoring shipments, vehicles and drivers is an increasingly complex part of the business. They are also vital parts of industrial vehicle business that have to be kept under tight control: time is money and competition is tougher than ever.

Travel, traffic and transportation management are the present and the future of mobility with new concepts and innovative technologies.

Fleet management services enable the management, tracking, maintenance and accounting of vehicles and fleets of all sizes, from transport and vehicle management to driver support services, in order to support customer in the day-to-day running of their core business.

The marketplace offers a wide range of software products and components as well as consulting services, covering trip planning as well as fleet management based on monitoring and real-time control.

They are available as single or packaged solutions, with or without user interface or fully integrated into the user’s software environment.

The advantages are various: costs reduction for routine activities; better service and more customer satisfaction, delivering on time and keeping customer appointments much better; improved planning following each status change for vehicle, order or driver; better overview, for example vehicle positions; complete clarity of transport services; and so on.

The first step, which is sometimes not as obvious as people might think, is to recognise the specialist nature of vehicles. Combined fleets of cars, vans and trucks often lose out by treating the latter the same as the former, whereas vans and trucks should actually be managed with an eye always fixed on their commercial viability.

Improving the efficiency of fleet operations is about getting the most out of the assets involved. When those assets are expensive and complex, such as commercial vehicles with specialist equipment, businesses can start the process by using external funding. Given the pressure on their balance sheets, taking vehicles on an operating lease or contract hire can help to boost gearing ratios. It also allows that they don’t have to tie up their capital in high-cost vehicles and can minimise the risks associated with operating commercial vehicles.

Efficiency also means using the vehicles as effectively as possible, which in turn involves keeping them on the road and minimising downtime.

Therefore, it is important that the service centre knows the exact position of a vehicle, a driver or an order and its current status. The vehicles can be traced in detail, so that exceeded time limits or deviations from planned routes can be quickly recognised. A modern fleet management system provides the infrastructure for tracing vehicles using satellite and tracing mobile telephones on the basis of radio networks. It provides the communication between planners and drivers with individual mobile end devices (handheld, on-board computer, PDA, laptop or mobile telephone) and data exchange, using diverse channels (GPRS, UMTS, GSM/SMS, GSM/Data channel or WLAN).

Furthermore, an effective maintenance management solution can help van and truck fleets and is the reason why contract hire is growing in popularity. After all, a service, maintenance and repair network is an expensive luxury for many companies, so it makes sense to outsource to someone

who can do it cheaper and probably better. Buying in maintenance on a fixed cost basis can also help with forecasting and budgeting.

This underscores the importance of fleet management. No matter how efficiently those trucks are funded, it means little if they're not doing their job. Fleet management means more than just maintaining the vehicles; it also includes, for example, managing vehicle downtime, accident & incident management and breakdown assistance.

Of course, fleet operators also need the right information in order to manage their vehicles. Effective management reporting can allow them to identify trends and take action where necessary. For example, if a particular vehicle is off the road too often, reporting can help to determine why. It also allows operators to analyse and manage areas of cost that might not otherwise be apparent, such as excessive misuse and accident damage caused by rogue drivers. Driver training can help to alleviate such problems.

Operational efficiency is something within reach for all commercial vehicle fleets. The key is to understand and have visibility of every aspect of the fleet and manage them all. Everything from the design of the vehicle to the response speed of breakdown assistance can have an impact on a fleet's efficiency. That will in turn have a real impact on the company's bottom line.

7.5.1 Available systems

Several truck automotive manufacturers or service providers, like Scania, Volvo Renault, Man, Paccar, Caterpillar, Komatsu, Fleet Board, provide a wide variety of fleet management services in order to support efficient transport at competitive prices in a competitive environment.

The aim is to encompass the new concept of “productivity on the road”, as IVECO promotes. The starting point is the need of transport operators in increasing productivity, extending security and better using infrastructure.

In the following we report some of the characteristics of these systems. Some of these functionalities, relevant with respect to IPDFM will be assessed and rated in section 7.8.

7.5.1.1 IVECO

The areas in which the advantages of the Iveco concept of Productivity on the Road are most evident are:

- Low running costs: analysis and documentation of the vehicle/load data, management of maintenance, diagnosis and service.
- Transport efficiency: tracing the vehicle/load/package, management of orders/missions, courier services, navigation, etc.
- Efficient fleet management: evaluation of driving style, operative driver management, driver administration, insurance services based on the use of the vehicle, customer relations, etc.
- Safety/Security: management of emergencies, preventive safety, anti-theft protection, videosecurity, etc.
- Adaptability to future standards
- Infotainment and communications: PC/Internet onboard the vehicle, secretarial services, shared resources with DVD/CD/radio/MP3/DAB, weather forecasts, POI (points of interest) etc.

It is applied to the entire range of vehicles: goods transport (light, medium and heavy), passenger transport and special vehicles.

7.5.1.2 SCANIA

Scania Fleet Management is a flexible offer, which helps to improve safety and security, expand business and reduce costs everywhere. In their own words:

“Scania Fleet Management is a set of computer-based services that let you connect vehicles to an office system via wireless links and the Internet. Communication between drivers and office staff is thus greatly improved.

Transport Management Services increase operational efficiency and cut transport planning and administration costs:

- Scania Order Support – gives a fast and efficient way of handling job orders. It is designed to be integrated with your existing transport management system and allows job orders to be sent out and monitored from the office. Can be tailored to fit in seamlessly with your user interface.
- Scania Driver Log – makes it easy for drivers to accurately record activities and time. It can be integrated seamlessly with your current salary administration system. Or its logged data can be viewed in report form on the Scania Fleet Management web portal.
- Messaging– allows you to exchange text messages with individual vehicles or groups.
- Positioning – gives vehicle positions in text (e.g. 7 km SE of Bremen) and latest vehicle status without contacting the drivers.
- Tracking –enables you to track progress of each vehicle along its route – as well as showing any alarms.
- Office Map – provides detailed map with positions of vehicles and Scania workshops; includes zoom and search functions.

Vehicle Management Services monitor vehicle and driver performance, enabling you to make improvements that reduce operating costs and improve uptime:

- Vehicle Data – automatically collects and presents vehicle information on distance, speed, fuel consumption and odometer readings. Allows you to identify vehicles that deviate from expected performance norms and take corrective measures.
- Trip Report – automatically collects and presents more detailed information about individual vehicle, driver and trip performance. Helps drivers improve their performance with regards to fuel consumption, brake use, etc.
- Zone Alarm – sends an alert if vehicle leaves a specified geographical area. The alarm message can be seen on the office PC and sent to a designated mobile telephone or email receiver.
- Vehicle Alarm – sends an alert when the theft alarm, alarm button or a connected external alarm is triggered. The alarm message, consisting of the vehicle’s position given in text and on a map, can be viewed on the office PC or a designated mobile telephone.

Driver Support Services are designed to increase driver productivity, comfort and convenience:

- Moving Map – a map with GPS vehicle position, route planning and Scania workshop locations; includes zoom and search functions.
- Navigation – optional service giving turn-by-turn voice and visual instructions down to street number level.
- Camera View – shows view from appropriately mounted camera on vehicle’s computer display. Useful for checking rear of vehicle, viewing close-ups or blind spots, etc.
- Phone – GSM mobile phone with text messaging, large digits, hands-free operation and address book that can store hundreds of telephone numbers and addresses.
- Drive Time – current, daily and weekly information about time driven, mandatory rests, etc. (reminders for the driver to comply with EU regulations).
- TV – an optional extra available for off-duty entertainment when the truck is parked”.

7.5.1.3 MAN

Modern telematics opens a whole new world of unique opportunities for fleet control, management and logistics. Everything revolves around direct communication between shippers and their trucks, or if need be, with loading facilities. All partners in the transport chain can react faster and more flexibly, resulting in increased performance at considerably lower cost. Depending on customer needs or convenience, MAN offers tailored solution.

In particular, Fleet Management consists of four modules which form the basis for economical running of a fleet:

- 1) MAN project management: one of the tasks of this course is to give our customers advice when important decisions concerning their fleets have to be made. If new vehicles have to be purchased we develop concepts tailored technically and in business-related matters to precisely to the needs of our customers.
- 2) MAN procurement management: it accompanies a new MAN truck on its way from the factory to the customer.
- 3) MAN Fleet Management: the experts take care of everything connected with ordering, transfer and registration. MAN fleet management offers services relating to everything important to the transport business that has to be done but draws focus away from the core business. This includes, for instance, monitoring all cost curves, tank card management, checking repair invoices or handling radio fees.
- 4) MAN returns management: it ensures optimum realisation of used vehicles. The MAN staff bring in the vehicle that is to leave the fleet, deregister it, carry out the final calculations and organise a replacement vehicle if necessary.

7.5.1.4 FLEETBOARD

Born in the form of the FleetBoard project inside Daimler Chrysler in 1999, FleetBoard laid the foundation for its independent development and provision of fleet management services for truck manufacturers in 2003.

Vehicle Management: FleetBoard offers objective and comparative data from each freight vehicle in the fleet, which provides an overview of the operational performance of individual vehicles, fuel levels and consumption as well as drivers' work profiles, which includes evaluations and gradings. In this regard, the fleet manager gets support to identify causes of high fuel-consumption and to use these figures to reduce costs of the entire fleet. Ensuring optimal flexibility, maintenance and service information can also be called-up easily online.

The Performance Analysis is the core of FleetBoard Vehicle Management. This FleetBoard service package allows analysing and surveying each freight vehicle in the fleet. On a scale from 1 to 100, each vehicle and driver gets objectively evaluated. Factors such as the Total distance, Speed, Idling time, Braking behaviour and Average total consumption are taken into account. The collected data provide information on fuel-saving and efficient driving behaviour for each individual vehicle or driver.

Thus the FleetBoard Performance Analysis assures the optimal basis for an objective, performance-based bonus system or even for a competition, as the FleetBoard Drivers' League proved impressively with its results during the last years.

The trip recording documents in detail the entire course of the trip. Among other things, the travel and stoppage times, the position, the weight of the vehicle, the consumption and its average speed are displayed. The time range of the analysis can be freely selected. The data obtained can then be used by the accounting department for final calculation of trip costs. All of the important trip data can be shown on a digital road map using the FleetBoard mapping service. The direction of travel and the length of the breaks are displayed visually as well.

The FleetBoard transport management services offer an abundance of functions to make the daily forwarding routine easier. Today, efficient communication with the driver goes far beyond mere telephone calls.

FleetBoard provides essential support to drivers and managers in their daily work, thus contributing to efficiency and economy. Sending order data online to the vehicle drivers was not possible in the past. Services such as shipment tracking help to increase customer loyalty by making the work easier for the forwarding agency's clients as well.

The use of navigation systems in the trucks is helping drivers to find their way easily and safely in unknown territory. And managers have an overview of their vehicles at all times on a digital road map.

Mapping: at the touch of a button, the scheduler knows exactly where his vehicles are currently located. It doesn't matter whether he's looking for a single vehicle or needs an overview of his entire fleet.

On FleetBoard Mapping's digital road map of Europe, he receives all the information he requires at a glance. Thus the progress of individual vehicles can be displayed for a defined period, with breaks and the speed driven indicated.

Individual points on the map, e.g. unloading or loading locations of regular customers, can be defined using the POI (points of interest) manager. Useful information such as the locations of petrol stations, parking lots or motorway service areas is likewise shown.

The FleetBoard DispoPilot provides the driver with a navigation system that covers all of Europe, showing the correct route with the arrow on the colour display as well as providing audio directions.

With the transmission of order data to a vehicle, the DispoPilot can transfer the received delivery or pick-up address directly into the navigation system.

The territory monitoring function informs the driver and scheduler when a vehicle enters or leaves a defined area. Thus, for instance, schedulers are informed when the vehicle is 30 kilometres away from its destination.

For the driver, this offers the greatest possible convenience and safety, as it enables him to reach his destination quickly without unnecessary detours.

7.5.1.5 PETERBILT

Peterbilt Motors Co., a division of PACCAR Inc, manufactures premium quality trucks and offers a broad range of services for the over-the-road, construction, municipal and medium-duty markets.

Customized Cost Management Tools through Convenient TruckCare Cards: Meeting the needs of owner-operators and fleets, TruckCare Cards provide flexible accountability for tracking and controlling over-the-road expenses in a very easy way. There are two non-revolving credit cards - the TruckCare Plus Card and the TruckCare Plus MasterCard - and one revolving credit card, the TruckCare Select Visa Card. Each card is designed to meet specific needs of particular customers, and all of the cards feature a graphic of a Peterbilt truck.

TruckCare Plus Card and Mastercard allow customers with two or more trucks to operate with a single, highly accountable form of paying for fuel and maintenance expenses. Each card can be customized with daily or weekly spending limits and immediate adjustments and restrictions can be made to any card at any time.

- Accounting and cost control is simplified through a single invoice that can detail purchase and payment activity by driver, by vehicle and even by expense category. The invoice is sent via fax or e-mail, and you can elect to receive it daily, weekly, monthly or at other intervals you determine.

The TruckCare Select Visa Card offers convenient purchasing power on anything from parts and service to utilities and insurance. It is easily to manage expenses at home or on the road with great benefits, such as no annual fees, Online access to account information and electronic bill payment service, 24-hour customer service, Low introductory annual percentage rate (APR) for balance

transfers and cash advance checks and so on. The TruckCare Select Visa Card works like any other Visa Card and can make it easier and more efficient to manage costs.

7.5.1.6 VOLVO

Dynafleet Online from Volvo Trucks is the market's leading system for transport information.

In their own words:

“You can see the current location of each vehicle in real time, as well as its fuel consumption, any messages that have been sent, driver duty times, service intervals and much more. Volvo is now introducing a fast connection via GPRS, which is faster and cheaper than GSM. All with the aim of lowering your costs and raising your efficiency.

Dynafleet Online is Web-based. All you need is a computer and an Internet link to gain full control over your operation - wherever you are in the world.

A transmitter/receiver is installed in the vehicle. The office and driver can communicate with each other at any time using text messages. Information about the vehicle and driver is transmitted to Dynafleet's database where it is analysed and presented to you in clear text in the form of various reports. You decide yourself who is to have access to each of these reports.

Dynafleet Online gives everyone in the transport chain important information, increasing efficiency. It in turn increases understanding of the whole picture, and expensive misunderstandings can be avoided. Assignments are carried out more efficiently and planning is smoother”.

7.5.1.7 KOMATZU

Komtrax is the Komatsu Satellite Tracking System. With it, you can locate your machines instantly - wherever they are, on site or otherwise - through the use of satellite technology.

Tracking lost or stolen equipment is straightforward with Komtrax.

Komtrax allows you to obtain real-time service hour meter readings - helping to ensure that you are getting maximum output from your fleet.

Data obtained from Komtrax can enable you to schedule equipment usage more effectively, and plan your repair and maintenance programme more efficiently.

7.5.1.8 CATERPILLAR

Given the harsh operating environment for Caterpillar machines, it is not surprising that equipment failure occurs from time to time. Although equipped with state of the art Vital Information Management System (VIMS), fault detection, diagnostics and prognostics are based on thresholds set with limits to minimize false alarms. Component faults contribute to increased Maintenance and Repair Contract (MARC) costs, operational disruption and outlays under availability guarantees. However, identification of potential failures when they first start to develop is possible.

Caterpillar offers the following technology products to improve fleet operations:

- Machine Security System: An Equipment Theft Deterrent System
- Product Link: A wireless system that simplifies the work of tracking your fleet
- EquipmentManager: A new way to manage your fleet
- RAC: Road Analysis Control
- VIMS: Vital Information Management System. The current release includes VIMSpc.
- VIMS Supervisor: Vital Information Management System Supervisor Software provides custom fleet production and maintenance reports by extracting data from the VIMS PC Database.

In particular, EquipmentManager is a new way to manage your fleet. It provides valuable information about your fleet of equipment allowing you to manage your entire operation more efficiently. Depending on your information needs, EquipmentManager can help you:

- Manage the location, security and basic usage of your assets
- Schedule events like planned maintenance and major repairs
- Address condition-based events such as diagnostic codes
- Detect small problems before they may cause a major component failure
- Increase machine availability
- Identify operator training needs

With EquipmentManager you have options to choose from in order to obtain the kind of information that best meets your fleet management needs, and the ability to change them at any time. Searches for information can be made in several ways - such as groups of machines, equipment ID, make or model. With EquipmentManager, you're in control, you set preferences for the way you work.

There are two Ways to Manage Your Fleet:

1) By Exception

These exceptions include the following:

- Time-fencing and geographical fencing violations
- Maintenance due
- Major repair due
- Diagnostic code alerts
- Diagnostic events
- Fuel level alert

2) By Machine-specific Information

EquipmentManager also provides a search function that lets you search for information on a specific piece of equipment. You can perform a search by group, equipment ID, make, or model. Or you can conduct an advanced search. (For example, you might search for all machines within 100 miles of a given location that have PMs due next week.) After initiating either search, you receive results in an Event Summary report.

Online Tracking and Management of Machines

The EquipmentManager application works with other applications such as PartStore and Equipment Data to simplify fleet management. The program uses three levels of machine status—red (requires immediate action), yellow (requires monitoring), and green (normal)—and you can send alerts to a pager, cell phone or other device. The status indicator box on the home page links you directly to a listing of all machines at a given status. There you can view brief event descriptions and obtain further information, such as maps that pinpoint locations.

7.6 Assistance and Fleet Management Systems

Nobody can argue against the increasingly tough conditions facing haulage companies. Transport costs are extremely vulnerable to price, customers are placing increasingly stringent demands on delivery precision and just-in-time operations.

Therefore the success of this business demands solutions that minimize downtime, reduce costs and keep your equipment running at peak performance.

By offering a wide range of solutions and services, manufacturers support customer to achieve maximum output by putting customer support first. They can service, repair, maintain, monitor and track machines and supply, fit and service their parts and components. Time is money, and the less time a truck spends in the workshop, the more money it earns.

In the marketplace the basic offer consists in more or less flexible maintenance and repair packages, together with non stop assistance to customer throughout an efficient Dealer and Workshop network supported by Client Centers.

Maintenance and Repair packages offered by manufacturers ensure timely vehicle servicing and, in accordance with customer requirements, completely or partly cover any necessary service operations.

In this way manufacturers guarantee to the customer a highly qualified, technologically updated service in addition to ensuring the vehicle is in the hands of a dealer network or authorized workshops, that always operate in observance of the highest possible quality standards established by manufacturer itself.

Transparent costs, vehicle safety, availability of a continuously efficient vehicle, higher second-hand value are guaranteed for the customers and can be tailored to suit specific service, maintenance and repair requirements. This allows customers to schedule precisely planned breaks at the most optimum times to suit both transport planning and the individual vehicle concerned.

Packages can include only maintenance operations scheduled at planned mileages and/or times (oil, fluid and filter replacements, various checks) or offer total coverage for the entire vehicle, often with a few well-defined exceptions (for instance, lighting units, damage resulting from accidents, batteries, tyres).

Sometimes the payment scheme is flexible too, paying for each service as it comes along or paying a fixed price per kilometre or even a predetermined monthly rate.

7.6.1 Available systems

7.6.1.1 IVECO: E.A.SY. (Electronic Advanced System)

Fast, precise identification of vehicle malfunctions and guidance that enables workshops to propose a fast solution to problems. Iveco has created a new diagnosis platform in line with vehicle developments to respond to these increasingly pressing needs expressed by both customers and the service network.

It's known as E.A.SY. (**Electronic Advanced System**), a system facilitating diagnosis of a vehicle's various electronic control units that uses a communications module (the ECI) and a specific personal computer for this type of application.

This PC has been designed as an advanced workshop tool: in fact it's shock-resistant, waterproof and has a screen that's perfectly visible even in sunlight, and if it's rotated it can be used in touch-screen mode too (that is, without using a keyboard).

The ECI module can communicate with all current - and future - Iveco control units, while the software interface is very user-friendly. New software versions for the E.A.SY. platform have been designed to provide a single, intuitive interface to consult a guide for repairs organised by symptom in a clear manner.

This, because the success of Advanced Diagnosis depends on availability of advanced tools in terms of fast response and performance, coupled with precise, updated, easily accessed information.

E.A.SY. is the heart of Iveco Advanced Diagnosis and represents the core of future's workshop also thanks to interaction with Teleservices and all other Iveco support tools with which this system can immediately be linked by exploiting its wide range of communications features.

7.6.1.2 SCANIA: Scania Diagnos tool

Time is money, and the less time a Scania truck spends in the workshop, the more money it earns. That is why Scania developed its own computerised fault-tracing system - Scania Diagnos - which considerably cuts downtime in the workshop.

The Scania Diagnos tool is connected to the truck's on-board microprocessor, in which all fault codes are stored. Scania Diagnos identifies the type of fault and even the exact location of the faulty component, so action can be taken immediately.

Since Scania Diagnos scans the microprocessor's history, it can also identify intermittent faults - which are normally very difficult to track with conventional fault-tracing methods.

7.6.1.3 MAN: Cats II

MAN-cats II is an external diagnosis system with the most extensive test depth for electrical systems in MAN commercial vehicles.

This diagnosis system is ideally suited to use in a workshop as well as mobile usage.

MAN-cats II is portable and robust. It enables workshops especially smaller ones - to inexpensively keep up with the new Trucknology technology in the vehicles.

The main components are a service computer, the communication interface and well as MAN-cats II software.

The modem or ethernet interface integrated in the Service Computer enables an online link to the central MAN-cats data server.

General

- Light and compact diagnosis tools for vehicles, bus chassis and stationary engines with Trucknology technology
- Independent thanks to wireless communication between service computer and communication interface (range to 200 metres)
- Regular software updates via CD ROM and data transfer
- Software available in over 20 languages
- Support by MAN-cats user service hotline
- Connection for printer

Vehicle diagnosis

- Control unit identification
- Read out, evaluate and delete diagnostic memory
- Actuator test (active triggering of actuators)
- Monitoring (visualisation and evaluation of current sensor signals)
- General circuit diagrams of systems retrievable

Miscellaneous

- HD-OBD scantool (from approx. Mid-2004) Heavy Duty On Board Diagnosis, read-out of data relevant to exhaust gas

Optional

- Can be expanded with additional software modules

7.6.1.4 KOMATZU: KOWA (Komatsu Oil & Wear Analysis)

KOWA involves Komatsu engineers visiting your site and proactively monitoring oil quality and checking for any contaminants that might accelerate wear on components.

KOWA can predict the onset of component failure, allowing repair or replacement at the optimum time and avoiding greater damage to your machine and the expense and disruption of downtime.

Reports are carried out to manufacturers' approved criteria. Of course we will send you copies, but you'll also have direct online access to these reports - and we will email you immediately we become aware of any potential wear risks.

KOWA provides useful evidence in validating machine warranties and service history.

VHMS (Vehicle Health Monitoring System)

The VHMS controller monitors the health conditions of major components and enables analysis of the machine and its operations. The VHMS controller monitors and stores all data received from the engine and transmission controller and various additional sensors on the major components. This way, it's possible to record the evolution of the machine's health condition. This data can be downloaded via a portable computer or via satellite communication. In both cases, Komatsu specialists can analyse this downloaded data and follow up trends in the

machine's condition. When using satellite communications, the Komatsu specialist can inform you whenever an abnormal condition occurs. This way, repair and maintenance costs can be optimised, and maximum machine availability can be maintained.

7.6.1.5 CATERPILLAR: S.O.S. - Oil and Coolant Analysis

Toromont's Scheduled Oil Sampling (S.O.S.) puts your equipment on a regular diagnostic program. S.O.S. identifies abnormal wear by determining the amount of various wear elements in the oil from a particular compartment. A computer-generated report, complete with interpretation by one of our lab technicians, is made available to customers through the mail or on the Internet. Sample data is then permanently recorded to track the history of each compartment of each machine and warn of impending failure. In addition to oil, our lab can evaluate fuel, hydraulic fluid and coolant for telltale wear particles.

Each Cat S.O.S. test provides three specific types of diagnostic tests.

1. Wear analysis - monitors machine wear by detecting, identifying and assessing the amount and type of metal wear elements found in used oil.
2. Chemical and physical tests - detects the physical presence of unwanted fluids (water, fuel, antifreeze) in the oil.
3. Oil condition analysis - identifies loss of lubricating properties by quantifying combustion by products (soot, sulphur, oxidation and nitration products).

With S.O.S., all fluids are tested - not just engine oil. And, because sample test processing is done at your nearby Cat dealer, results and recommendations are usually available within 24 hours of receipt of your sample.

Since speed is important and delay can be costly, if a critical situation is identified you are notified by telephone immediately, or by fastest means possible.

Importantly, when you receive your S.O.S. test results, it is clear, concise and easy to understand. It calls for specific, immediate action and/or makes carefully outlined recommendations - recommendations that add efficiency and productivity.

7.7 Voice of the customer: the Truck Driver and Fleet Manager requirements

From a technology perspective, the trucking industry is driven by immediate or short-term requirements on return-on-investment (ROI) (See Figure 27). A series of government- or industry-sponsored ITS/CVO cost-benefit studies conducted over the last eight years show that ITS investment by carriers must meet several requirements, including short-term ROI, manageable per-unit costs, and ease-of-use (to reduce labour and training costs). The primary objectives of these systems should be quantifiable benefits to operational efficiency and positive impacts on safety. With the events of 9/11, carriers now attempt to meld safety and security objectives into a single grouping.

However, while certain safety technologies have proven value, their security benefits are unclear; the alternative is even more challenging: speculative (untested) security systems that propose safety or efficiency benefits. The bottom line is that industry profit margins rarely exceed 4 percent, often relegating security technology investment to some unclear point in the future.

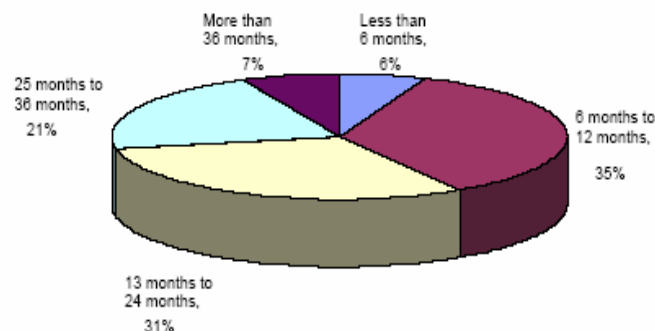


Figure 27: Maximum acceptable payback period for in-vehicle technology investments

Large-scale ITS (see [6]) systems such as fleet tracking and communications, electronic data management, and advanced safety systems are often viewed as luxuries affordable only to large fleets. Research bears this out; smaller carriers are more risk-averse than larger carriers and often consider technology systems only after they've been fully tested by larger carriers and the production economies-of-scale are in motion (see following figures, where the “power units” are the rating scale used by the interviewees).

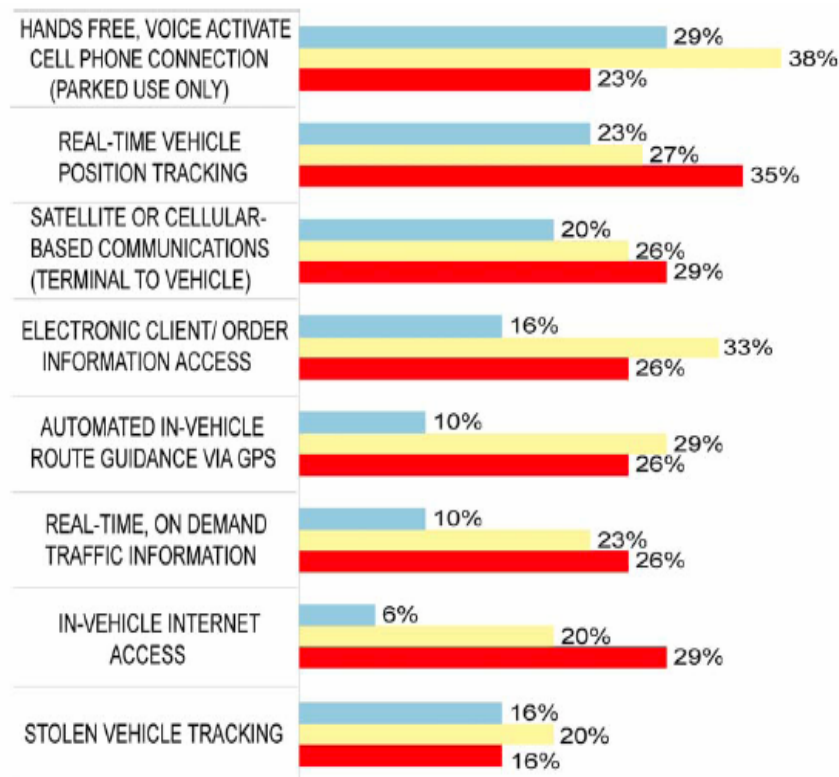


Figure 28: Most common in-vehicle applications now deployed by fleet size

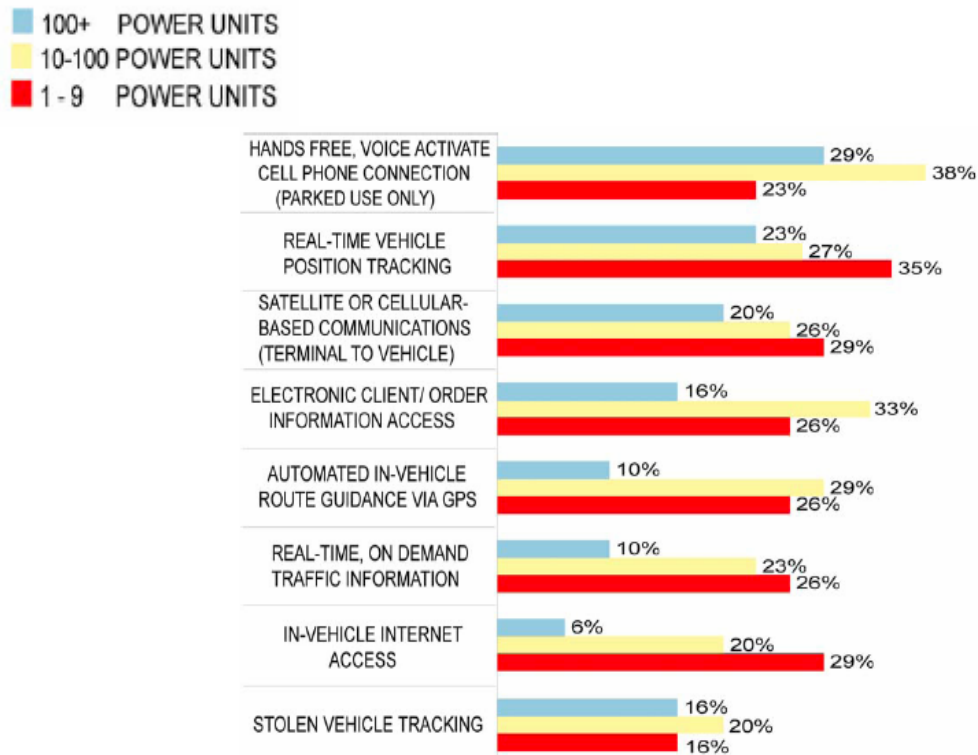


Figure 29: In-vehicle applications most likely to be deployed into existing fleets

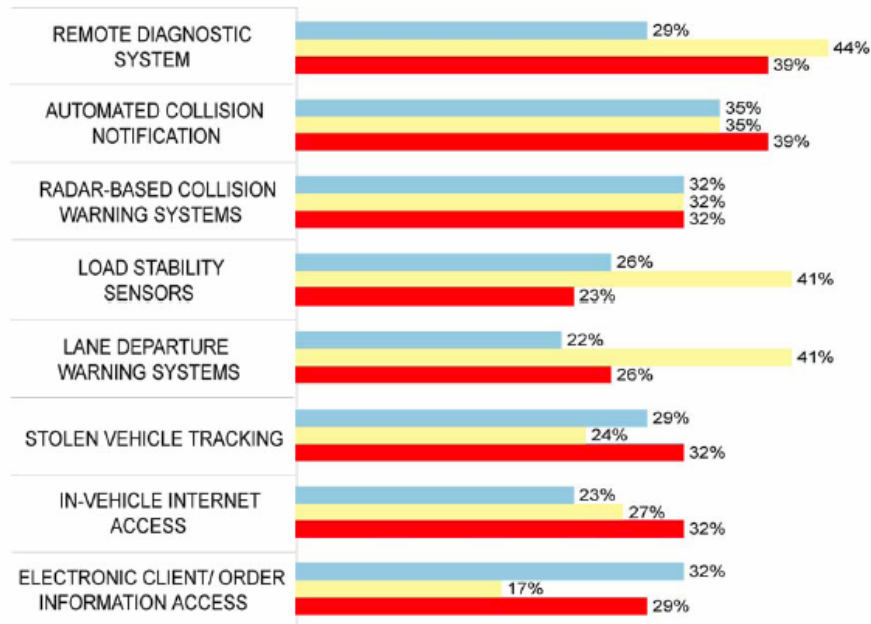


Figure 30: In-vehicle technologies most likely to be deployed in future vehicles

In the trucking industry, technology investments appear to be a reactive response to a specific operating objective. The industry's small operating margins typically do not allow motor carriers to engage in speculative R&D, hence there are few tech labs and research centers housed within, or funded directly by carriers (industry original equipment manufacturers (OEMs) and vendors are of course an exception to this).

Rather, technology investments are made in response to internal or external economic pressures that can most effectively be addressed through the productivity or safety benefits that technology offers. These are often discovered after non-technology solutions are considered and negated (at this point in development, many technology concepts are borrowed from other sectors and applications. For example, most driver simulator systems and experiments can trace their origin to military or aviation programs). In relation to onboard technologies, the objectives are relatively simple, although the technologies themselves are not: most onboard technologies focus on assisting the driver or the vehicle in managing information. With the former, the assistance focuses on reducing accidents and violations; with the latter, it reduces operating costs (less often, it increases revenue).

Ultimately, only those technologies that reduce accident impacts or produce positive net marginal gains will be considered or maintained over the long run.

Why Users Renew...		... Or Not	
View as an insurance policy	95%	Cost	69%
Want latest features/technology	20%	Don't get value for money	53%
Use telephone capability	20%	Do not need service	31%
Use often to get to unfamiliar places	17%	Did not want to begin with	23%
It helps me to get to destination	17%	Other	10%
Others	6%	Not satisfied with service	8%
Use for business travel	4%	Service is difficult to use	3%

Table 10: Telematics Subscriptions ([1])

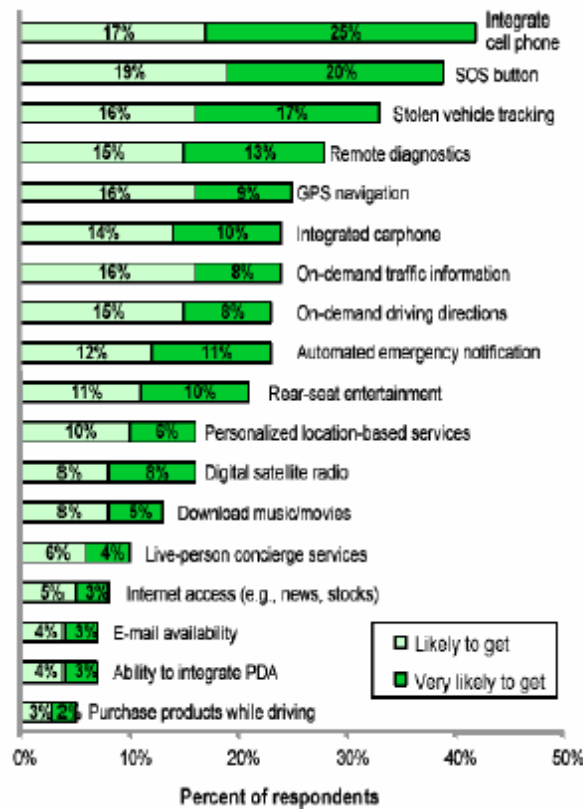


Figure 31: Consumer Likelihood to Buy Telematics, source Gartner [7]

The Figure 31 above summarises the perspectives for the Fleet Management Systems, in particular in the area of maintenance and remote diagnosis for the single vehicle: more “infotainment” for the driver, more management of the load, truck and driver for the fleet owner, in particular in the areas of security, tracking and diagnostics.

In the following chapter we will thus enter in details about the technical characteristics of the Fleet Management systems which will be developed for IVECO in the framework of the PROMISE project, how it can be positioned with respect to the current competitors, and which are its main competitive advantages.

7.8 Competitive positioning

In this chapter we describe the competitive positioning of the IVECO PROMISE DSS for Fleet Management (IPDFM).

7.8.1 Description of the technical characteristics of the system

The Decision Support System (DSS) that will be implemented is designed to improve maintenance management on commercial vehicles. This maintenance management tool is part of a wider project meant to re-define the maintenance procedures to be applied to a fleet of trucks.

The approach is based on a predictive maintenance algorithm that exploits the advantages resulting from the installation of a set of sensors constantly monitoring the status of a selected bunch of engine components. The entire lifecycle of the different monitored components and of the whole vehicle is taken into account since the first stages of the DSS design.

Having a real-time monitoring of the actual status of components of the truck allows the fleet administrator to effectively and efficiently manage the maintenance activities on each truck.

Data collected from sensors installed on the selected components are the inputs of the algorithms. A calendar of maintenance interventions to be performed on each truck belonging to the analysed fleet is obtained. The output minimizes costs related to the remaining steps of the components lifecycle.

The proposed approach passes through **two main modules**: a DSS optimising the maintenance on one single truck is the core of the first part of the tool, while an optimisation of the

maintenance activities to be performed on an entire fleet of trucks is the aim of the second module.

The first module of the DSS is devoted to the optimisation of the maintenance interventions on one single truck. The new planned maintenance process passes through the following main steps:

- collection of data from sensors
- sensors data elaboration and components lifespan computation
- definition of truck availability
- definition of a maintenance plan for each truck

The DSS takes as input the data concerning the lifespan and supports the last two steps mentioned.

The core of the DSS for a single truck is the definition of a maintenance plan. The system has collected all the needed inputs:

- residual lifespan for each component
- time intervals of truck availability
- pre-scheduled maintenance milestones

The main objective of this step is to identify the “best” time interval for stopping the truck and performing needed maintenance activities and, moreover, to define which kind of maintenance has to be performed on which component. The intervals defined by the user (truck availability) are taken into account as the preferred options, however it may happen that the DSS schedules maintenance intervention outside them if it is necessary to avoid component breakdown and/or too expensive interventions.

Monetary dimensions are taken into account for this optimisation. In particular for each one component the following cost entries are considered:

- 1) Costs due to vehicle unavailability [€/day]
- 2) Costs of intervention:
 - Material [€], Manpower [€], Waste disposal [€]
- 3) Extra costs / problems due to intervention delay (all function of the extra mileage):
 - Vehicle inefficiency
 - Risk of major failure with economical loss
 - Risk of failure with potential hazard for the vehicle / people

What described until now is part of the first DSS module. Using the point of view of the fleet manager, however, optimising the maintenance only at the truck level would be a sub-optimal solution. The main goal of the second module of the DSS is to find out an optimal solution at the fleet level.

All the data from the different trucks belonging to a fleet have to be collected in a ground-station computer, in order to simultaneously take into account the different needs and availability of all the trucks. Therefore, data of the different trucks belonging to the same fleet are grouped and optimisation for the fleet is performed. Calendar of interventions is sent to the maintenance crew and to the different trucks.

In particular steps belonging to the DSS second module which have been identified till now are:

- Collection of data from the different trucks belonging to the fleet
- Collection of garage availability
- Identification of alternative options and optimisation
- Transmission of results (calendar) to the truck drivers and to the maintenance crew.

7.8.2 Description of the competitive basket

The present paragraph addresses the positioning of the PROMISE DSS for Fleet management with respect to a restricted basket of competitors (the “reference basket”). The criteria for selecting them will be presented, as well as their major features.

The following table summarises the competitors which have been selected as the total basket of competitors. It includes all the major players in the area of fleet management, including the fleets of cars, and some solutions delivered by the OEM (of trucks⁶, cars or other vehicles⁷).

Competitors	References
Auto Q	www.auto-q.com
Belgravium	www.belgravium.com
Box Telematics	www.boxtelematics.com
BT AutoID	http://www.auto-id.bt.com/default.htm
Cummins Road Relay	www.cummins.com
Foden Trucks	www.foden.com
Groeneveld	www.groeneveld-groep.com
ICS Black Box	www.boordcomputer-black-box.nl
Isotrak	www.isotrak.com
MAN	www.man.co.uk
Maple Group	www.mapletechnology.co.uk
Mercedes-Benz	http://www.fleetboard.info/
Onstar	http://www.onstar.com/
Qualcomm	www.qualcomm.com/qwbs
Roadrunner Cab-Link	www.roadrunnercablink.com
Scania	www.infotronics.scania.com
Siemens VDO	http://www.siemensvdo.com/
Amicus VSM	http://www.amicusvms.com/
Geomobilesolutions	http://www.geomobilesolutions.com/
Volvo	http://www.volvo.com/trucks/uk-market/en-gb/services/DFOL-2005/dynafleet_online_main.htm
Caterpillar	http://www.cat.com/cda/layout?m=40700&x=7
Komatsu	http://www.komatsueurope.com/as_pmclinic.cfm?lang_id=en
Isuzu	www.isuzucv.com

Table 11: Total basket of competitors

Following the criteria presented in Table 12, we restrict the study on a short list of competitors and focus on the 4 tools below:

- Amicus VSM: in synthesis, Amicus VSM offers an on-board platform, with data provided by as much as 12 sensors and an on-board analysis of engine or truck parameters (fuel, oil and others) (from <http://www.amicusvms.com/>)
- MAN ERF: in synthesis, MAN is offering a telematics platform for simple remote diagnosis (engine on/off) and analysis of trip data (fuel consumption) (from <http://www.manerf.com/telematics/default.asp>)
- Onstar: in synthesis, Onstar is a complete telematics platform for on-demand analysis of residual life for engine oil: transmission of data from the vehicle, analysis of data at the ground station, communication back to the car driver; the price is a fixed fee per month; more than 1 million of GM cars are equipped with this system (from <http://www.onstar.com/>)
- VOLVO Dynafleet: in synthesis, Dynafleet is offering an on-board analysis of such important driving variables such as top gear, engine load to perform remote analysis of the truck, and of-board real time monitoring of truck location, fuel consumption, planned routes, driver times, service intervals and much more (from http://www.volvo.com/trucks/uk-market/en-gb/services/DFOL-2005/dynafleet_online_main.htm)

⁶ Foden, MAN, Mercedes-Benz, Scania, Volvo.

⁷ Onstar (GM), Caterpillar, Komatsu, Isuzu.

In conclusion, the following table summarises the criteria used for selecting the competitors:

Choice criteria	Selected competitors
Similar characteristics or market	VOLVO Dynafleet
Basic and efficient technologies	MAN ERF
Broad range of analyses	Amicus VSM
Best existing product, even in different market	ONSTAR

Table 12: Choice Criteria for the basket

7.8.3 Technology benchmarking based on performances and features

Based on the description in Section 7.8.1 we have performed a technology benchmarking, based on a list of functionalities. The technology benchmarking (see [8]) is aimed at checking the PROMISE DSS for Fleet management overall coherence, in terms of functionalities and own characteristics, with respect to the basket of four competitors described above.

It represents the first step for the assessment of the economic potential, the attractiveness, the uniqueness, the appropriateness of the offer with respect to the market, and the proper strategic marketing of the solution.

The table below displays the compared analysis of the DSS and the basket of competitors. The second column from the left lists the criteria on which the evaluation has been performed. They are derived from the analysis of the “Users requirements”, performed by CRF at the IVECO sites during business analysis sessions (February-March, 2006). The users requirements have been divided into three groups, related to the on-board -, ground station- and methodologies functionalities⁸.

We have included both technical capabilities, or functionality (e.g. the ability to perform multiple modelling) and software characteristics (e.g. easiness-of-use). The latter, and a part of the former represent the necessary a priori requirements for a Fleet Maintenance Management system. The importance of such requirements, as defined a priori is included in the first left column. Then the IPDFM solution and the basket of competitors have been evaluated (a posteriori, i.e. after the importance has been defined, in order to avoid any bias in the evaluation) along those dimensions (see column 3 to 7). These votes have been awarded by a panel of management experts inside IVECO and CRF, based on the analysis of the capabilities of each solution and the resolution of some test cases. It will be enhanced with a thorough analysis of the same case study using the reference basket. In particular the IPDFM solution is not automatically the best performer for all requirements, as some prioritisation had to be done during the development.

Each functionality or characteristic has been given a code name (see last column), which will be used, in the following sections of this document.

⁸ The percentages in the most left-sided column of the table indicates that roughly the 3 clusters of functionalities have the same weight (between 30% and 38%), which assure that they have given the same importance.

On-board systems								
% of tot	Importance [1-10]	Functionality	PROMISE Fleet Maintenance DSS	Amicus VSM	MAN ERF	Onstar	VOLVO Dynafleet	N.
29%	10	Store data about vehicle (vehicle profile, maps...)	10	10	5	10	3	A
	8	Security and reliability	7	7	7	7	9	B
	4	Establish synchronous communication towards ground station	0	10	10	0	10	C
	10	Efficient data transmission	10	10	10	10	10	D
	7	Back up data storing solution	8	9	9	8	3	E
Ground station								
	Importance [1-10]	Functionality	PROMISE Fleet Maintenance DSS	Amicus VSM	MAN ERF	Onstar	VOLVO Dynafleet	N.
33%	10	Cost of solution maintenance (including transmission,...)	5	4	7	8	7	F
	5	Identification of truck location	0	10	10	10	10	G
	8	Minimise human intervention	8	3	4	5	3	H
	9	Open / modular solution (management of trucks and people)	8	0	4	0	10	I
	4	Historical Route Information (record of vehicle locations)	0	10	10	10	10	L
	3	Roadside Assistance	0	10	10	10	10	M
	6	Simplicity of use	7	10	6	10	8	N.
Methodologies and algorithms								
	Importance [1-10]	Functionality	PROMISE Fleet Maintenance DSS	Amicus VSM	MAN ERF	Onstar	VOLVO Dynafleet	N.
38%	6	User friendliness	7	10	6	10	8	O
	8	High processing capability	8	3	8	5	2	P
	10	Adequacy of the modelling (true wear-out estimation)	10	0	0	8	0	Q
	10	Capability of modelling the wear-out of different types of components	7	0	0	0	0	R
	8	Accessibility via web	0	0	0	0	0	S
	10	Scalability (Capability of extending the number of relevant handled objects)	8	0	0	0	0	T
Total			66%	51%	52%	58%	50%	

Table 13: Rating of functionalities for IPDFM and other competitors

The conclusions will be drawn in the following sections (quadrant and SWOT analyses). Note that the percentage indicated in the down most line is only indicative of the positioning of the solution with respect to the others. In particular we recall that the ratings have been defined assuming that the IPDFM will be developed and will fulfil the requirements expressed by IVECO.

7.8.3.1 Quadrant analysis

A specific Quadrant Analysis (see Figure 33 to Figure 38), performed on the basis of the Technology Benchmarking presented in the previous section, highlights the strengths and weaknesses of IPDFM and supports the definition of the relevant strategies (pricing, communication, product configuration, ...).

Figure 32 presents the standard Quadrant Analysis:

- the ordinate measures the relative importance of every function/feature (high or low) calculated as the gap from the medium importance (in the considered panel). An equal value to 0 indicates a medium importance of the attribute;
- the abscissa describes the relative performance of the IPDFM with respect to the rest of the panel (in our case Onstar and Volvo Dynafleet). A value of 1 means an identical perception of the two performances, while greater values than 1 indicate a competitive advantage.

Using the Quadrant approach may enable to identify the four “sectors” for which typical problems and corrective actions may be envisaged:

- **Strengths:** in the upper right quadrant can be found the functions/ features, which are relevant and representative of the product. The communication should draw on them.
- **Weaknesses:** the upper left quadrant summarises the weaknesses of the product, i.e. the functionality/ characteristic that are seen as not present in the product. These elements should be addressed and developed in an evolution of the product.
- **False Strengths:** the lower right quadrant summarises the “false strengths”, i.e. the functions/ features which are not perceived by the customer.
- **False Problems:** finally the lower left quadrant includes the “false problems”, i.e. the criteria that are rated low, but anyhow ranked low by the customer.

As said, the presented analysis has been performed on the functions and features of IPDFM, in direct comparison with the Onstar (see Annex for an example of the Onstar interface) and Volvo Dynafleet Systems. All the used Cod. Name letters correspond to the main functionalities and requirements presented in the technology benchmarking (see Table 13).

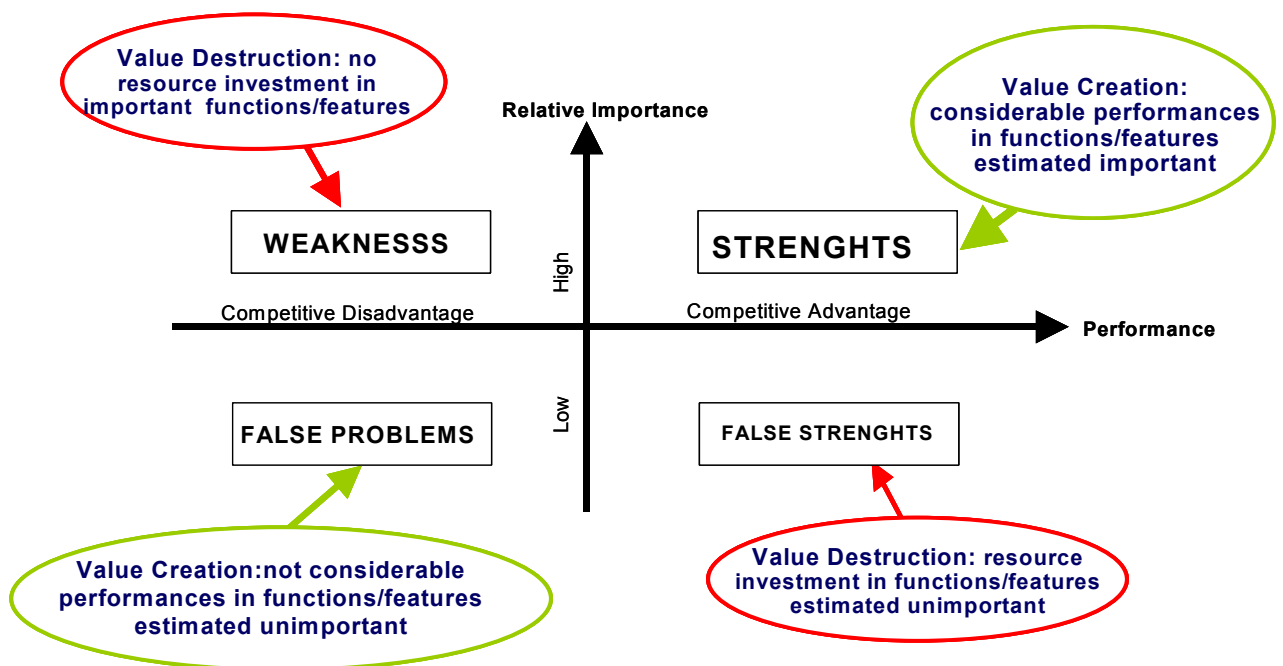


Figure 32: Quadrant analysis overview

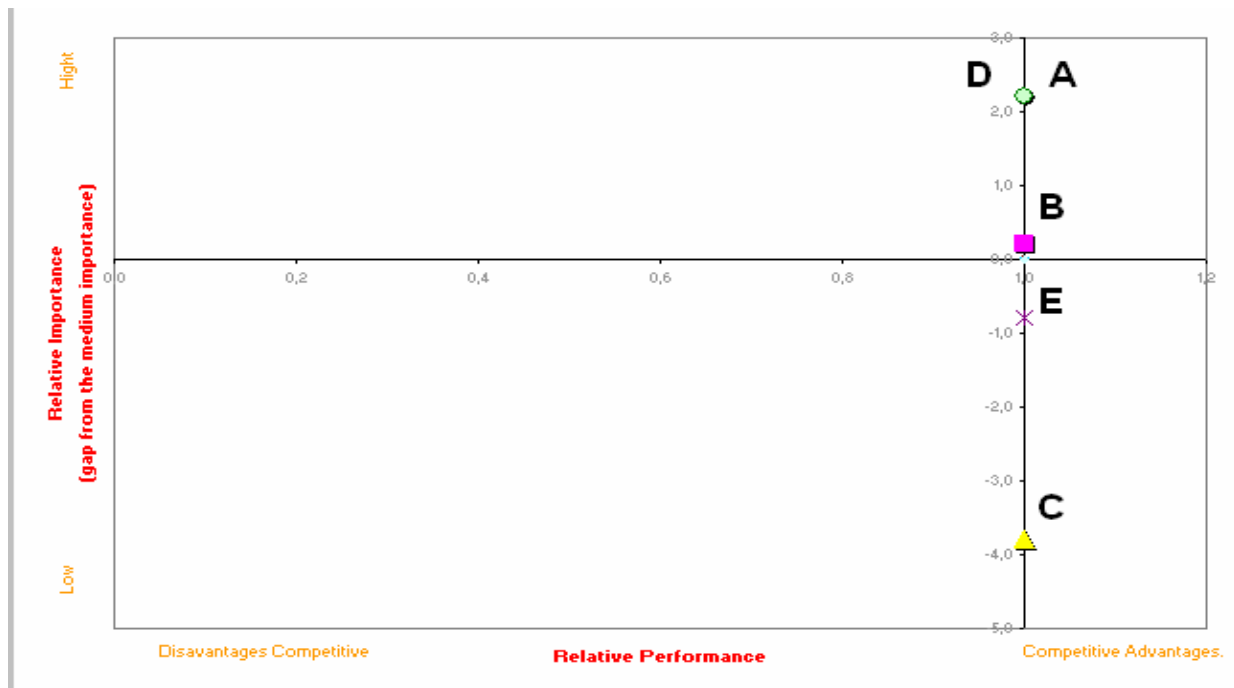


Figure 33: Quadrant Analysis Functions/Features (On-board systems) of IPDFM and Onstar

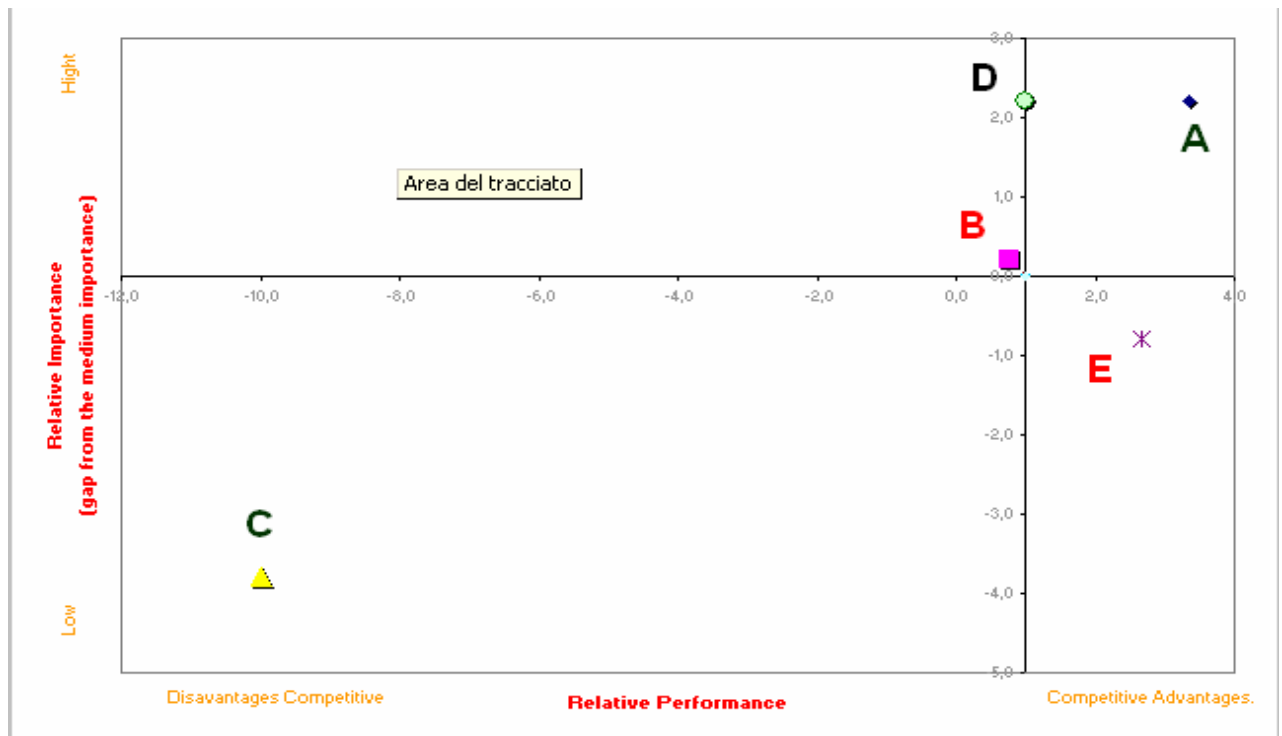


Figure 34: Quadrant Analysis Functions/Features (On-board systems) of IPDFM and VOLVO Dynafleet

Legend:

Cod name	A	B	C	D	E
Functionalities	Store data about vehicle (vehicle profile, maps...)	Security and reliability	Establish synchronous communication	Efficient data transmission	Back up data storing solution

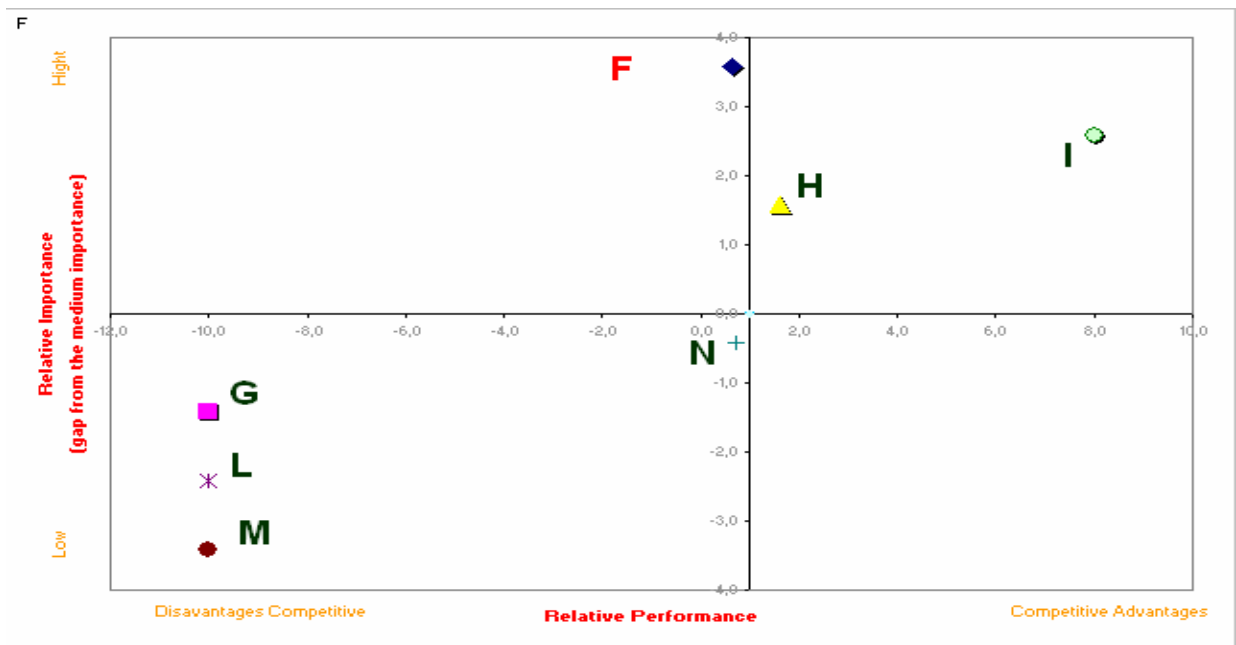


Figure 35: Quadrant Analysis Functions/Features (Ground Station) of IPDFM and Onstar

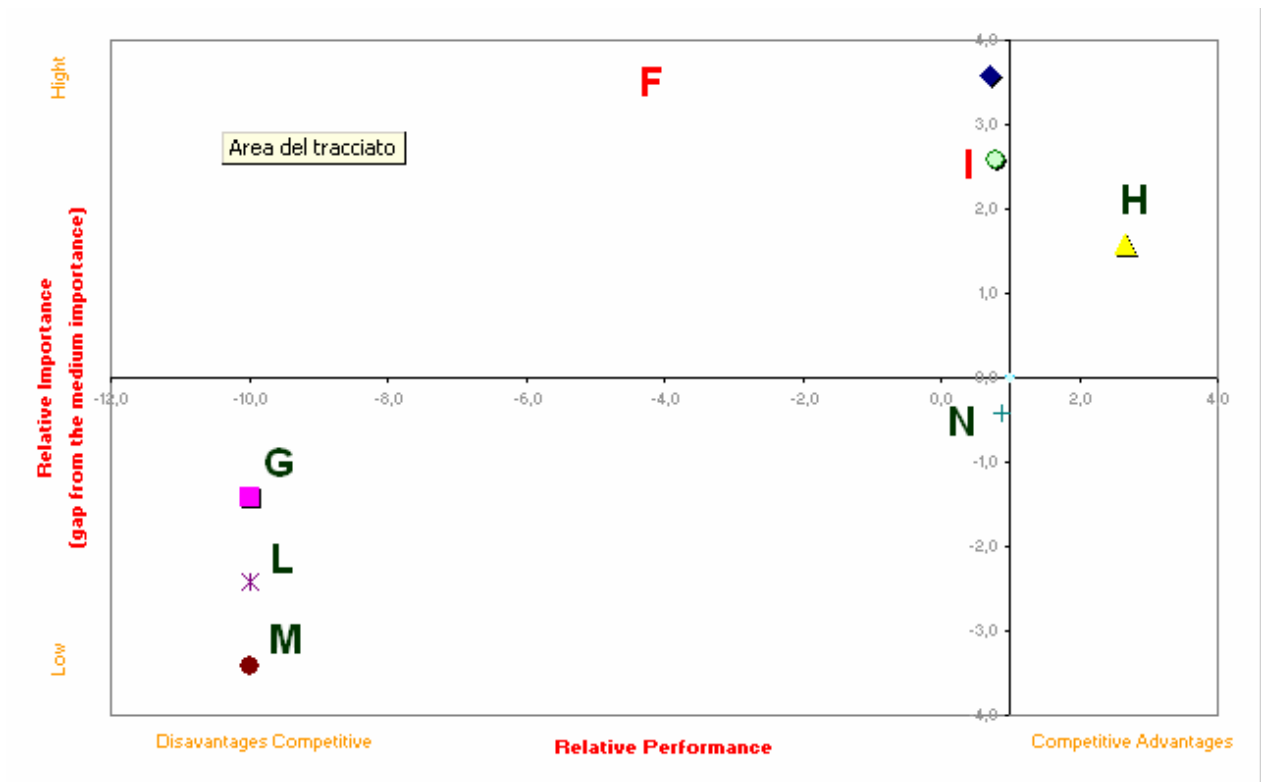


Figure 36: Quadrant Analysis Functions/Features (Ground Station) of IPDFM and of VOLVO Dynafleet

Legend:

Cod name	F	G	H	
Functionalities	Cost of solution maintenance (including transmission,...)	Identification of truck location	Minimise human intervention	
Cod name	I	L	M	N
Functionalities	Open / modular solution (management of trucks and people)	Historical Route Information (record	Roadside Assistance	Simplicity of use

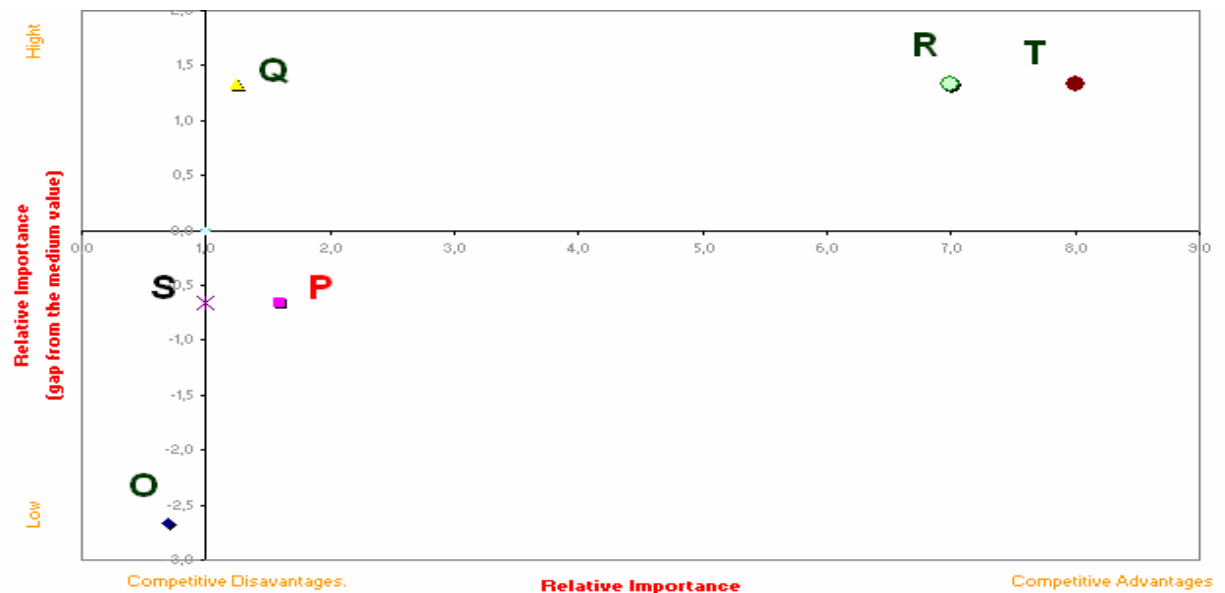


Figure 37: Quadrant Analysis Functions/Features (Methodologies and algorithms) of IPDFM and Onstar

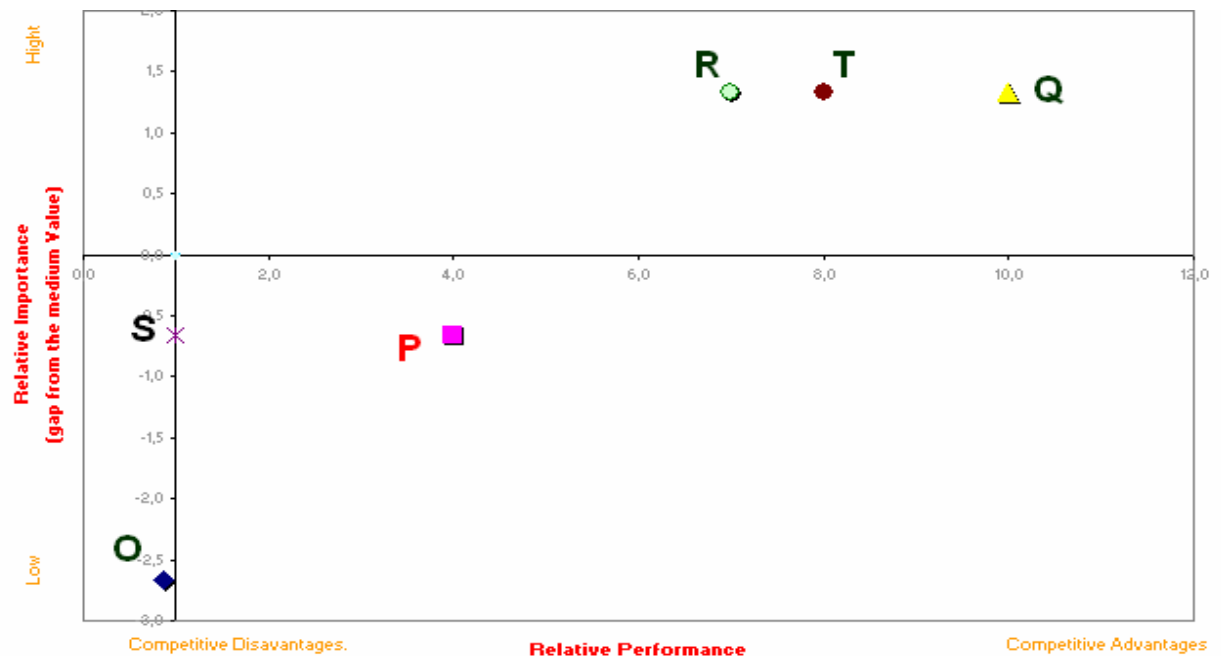


Figure 38: Quadrant Analysis Functions/Features (Methodologies and algorithms) of IPDFM and VOLVO Dynafleet

Legend:

Cod name	O	P	Q
Functionalities	User friendliness	High processing capability	Adequacy of the modelling (true wear-out estimation)
Cod name	R	S	T
Functionalities	Capability of modelling the wear-out of different types of components	Accessibility via web	Scalability (Capability of extending the number of relevant handled objects)

The following table then summarises the analysis above presented. All the functions/features of the IPDFM and the reference technologies ONSTAR and VOLVO Dynafleet are divided into four main items: Weaknesses; False Strengths; False problems; Strengths.

Cluster		Weaknesses	False Strenghts	False Problems	Strenghts
Definition		If there is a negative gap of the performance of these funcions / features versus competitors basket, it will be necessary to increase the level of these attributes in order to raise the competitiveness of Metal DPF	These functions/features are not relevant to the user. A marketing strategy would be to convince the user that these criteria are anyhow necessary to the use of the solution.Or in the other hand, it would be opportune to distribute the resources "diminishing" the level of these attributes in favour of the functionalities placed in the column "Weaknesses"	These are functions or features, for which it would necessary an opportune marketing strategy action, with which to increase the perception of the importance for the attributes in examination. They are functionalities to supervise continually , ..."that is not important today , it would become on the contrary very important tomorrow..."	These functions / features represent the major competitive advantages of the Metal fibre diesel particulate filter solution versus Competitors basket, on which the exploitation should draw.
On-board systems	Promise versus Onstar				
Ground station		Cost of solution maintenance (including transmission,...)		Simplicity of use	Minimise human intervention
				Roadside Assistance	
				Identification of truck location	Open / modular solution (management of trucks and people)
		Historical Route Information (record of vehicle locations)			
Methodologies and algorithms		High processing capability	User friendliness	Capability of modelling the wear-out of different types of components Scalability (Capability of extending the number of relevant handled objects) Adequacy of the modelling (true wear-out estimation)	
On-board systems	Promise versus VOLVO Dynafleet	Security and reliability	Back up data storing solution	Establish synchronous communication towards ground station	Store data about vehicle (vehicle profile, maps...) Minimise human intervention
Ground station		Cost of solution maintenance (including transmission et al)		Simplicity of use	Minimise human intervention
		Open / modular solution (management of trucks and people)		Roadside Assistance	
				dentification of truck location	
		Historical Route Information (record of vehicle locations)			
Methodologies and algorithms		High processing capability	User friendliness	Capability of modelling the wear-out of different types of components Scalability (Capability of extending the number of relevant handled objects) Adequacy of the modelling (true wear-out estimation)	

Figure 39: Synthesis of IPDFM strong and weak points vs two main competitors

7.8.4 Conclusion of the analysis

The Technology benchmarking and the Quadrant Analysis demonstrate that the IPDFM is to date among the winning approaches in terms of perceived value/quality⁹, with respect to the basket of worldwide competitors that CRF has considered. Indeed in an hypothetical ranking, it occupies the first position with respect to the current and next future competitors.

The final result is a favourable competitive positioning for the IPDFM:

- Strong points of the IPDFM are mainly concentrated in the Ground Station and Methodologies (vs Onstar) while the IPDFM performs better against Dynafleet for all clusters of requirements.
- The weak points of the IPDFM are concentrated in the Ground Station vs Onstar (the expected cost of the IPDFM is not completely defined, while the Onstar solution cost is known and reduced). Against Dynafleet the weaknesses are related to: costs (see previous point), to security (which is currently being assessed in the PROMISE R4 workpackage) and the modularity of the solution (which is under testing in this period of the IPDFM development).

So, the final score of the technology developed for the IPDFM, and evaluated at the best of CRF knowledge, is higher than the two main competitors technologies.

7.9 IPDFM potential market

This chapter summarises the founding of the previous chapters, providing a comprehensive picture of the strengths and weaknesses of the IPDFM approach and solution, and presents the conclusions of the analysis summarised in this document.

7.9.1 S.W.O.T. analysis

On the basis of the previous section analysis, CRF performed an analysis of the key factors that might affect the future development and diffusion of the Fleet Management Systems for Maintenance, which is the summarized in the S.W.O.T. analysis hereafter presented in the four separated figures (according to the classic scheme presented in Figure 40).

In particular, we refer to the “Strengths” and “Weakness” with specific concern for the IPDFM Features/Functions as compared with other existing Fleet Management systems or technologies, and to “Opportunities” and “Threats” with particular reference to the current and future market for systems for predictive maintenance of fleets in general. Inside each particular item, information and positions are not reported in any particular order of relevance.

Strengths	Weakness
Opportunities	Threats

Figure 40: Scheme of the S.W.O.T. analysis performed for the IPDFM

⁹ Expressed by the ratings achieved for each functionality.

Strengths

Minimise human intervention (Ground station)

Open / modular solution (management of trucks and people) (Ground station)

Capability of modelling the wear-out of different types of components (Methodologies and algorithms)

Adequacy of the modelling (true wear-out estimation) (Methodologies and algorithms)

Capability of modelling the wear-out of different types of components (Methodologies and algorithms)

Scalability (capability of extending the number of relevant handled objects)

Store data about vehicle (vehicle profile, maps...)(On-board systems)

The IPDFM offers an integrated solution where the competition is still lagging

The IPDFM can build on the strong brand images of IVECO & CRF as truck OEM and industrial research institute collaborating together

Table 14: SWOT Analysis: Strengths of the IPDFM

Weaknesses

- Cost of solution maintenance (including transmission) (Ground station)
- Technological maturity still to be assessed
- Aggressive and dynamic competitors, in terms of: costs, quality, technological performances
- Easiness of installing the integrated solution still to be proved: updating of ECU, installation of GPRS, ground station, connection to external databases...
- Existence of conditions under which the system has reduced performances still to be assessed: distance of transmission, concurrent transmission, number of components/ trucks...

Table 15: SWOT Analysis: Weaknesses of the IPDFM

Opportunities

- The market perceives the utility of the system / the interest in telematics services for fleets based on the use of wireless communication systems
- Promising scenarios for the diffusion in the market of Telematics & Wireless systems, as shown by some Strategic Analysis market studies
- Reduction of costs: Optimisation of lifecycle costs for trucks and fleets / Improvement of commercial efficiency / Data can be used to support truck based information service / Data may support the development of other fleet services (fuel consumption, driver monitoring)
- Dysfunction Reduction
- Improved safety (Safety/security is high interest of truckers and carriers)
- Sales of commercial vehicles worldwide show an increasing trend
- Diffusion of commercial vehicles fleets (leasing/ rental) show an increasing trend
- IPDFM may be sold in the AFTER MARKET, and installed as a retrofit on existing trucks
- Easiness of installation for the single components of the solution
- Some studies forecast the installation of such services as early as 2008 (Frost & Sullivan)
- Reduced cost of the solution
- Vector for company-wide optimisation: reduction of intervention time (*you know in advance what you have to change*), spare parts stocks, resources...

Table 16: SWOT Analysis: Opportunities for the IPDFM

Threats

- May not be perceived as an important feature by clients
- Scarce “willingness to pay” by the clients for the system
- Carrier/ truck drivers may perceive any type of vehicle monitoring as an invasion of privacy
- Success depends on how algorithms support decision
- Increased responsibility of the OME/ Fleet Manager in case of incident/ dysfunction
- Fragmentation of the Fleet market in Europe

Table 17: SWOT Analysis: Threats for the IPDFM

7.10 Final conclusions and future evolutions: IPDFM potential market

In this section we summarise the results of the previous chapters.

The scenarios detailed in Chapters 7.3 and 7.4 have shown an increasing trend on the market of commercial vehicles and of fleets.

In Europe the market shows some signs of saturation/ marginal increase, while the other markets will be the major pillars for such growth in the short-to-medium term future. In fact the growth is expected in emerging markets, like India, China, Brazil and East Europe.

Regarding the fleets, the study has shown that the market, following the examples of the US and UK markets are correctly oriented, towards the emergence of bigger fleets, managed by third-parties.

Furthermore the opportunities for Telematics systems, and in particular for remote diagnosis and maintenance management is growing, based on the perceived utility of remote monitoring and predictive maintenance (see Figure 30).

These are the driving forces which will sustain the growth of the development of more and more improved and performing Fleet Maintenance Systems. This will constitute an opportunity for companies involved in the production and marketing of FMS.

With respect to the rest of the competition, as described in Chapter 7.8, the IPDFM has the following recognised advantages:

- uniqueness of the solution;
- the comprehensiveness of the approach, based on the optimisation of maintenance of the level of the fleet;
- a patenting position which CRF consider to be strong (a patent has been filed and is currently pending);
- the CRF/ IVECO excellent brand image in terms of Industrial Research and Truck OEM.

Still, there are some weak points, which have been analyzed in details in Chapter 7.8 and Section 7.9.1. In particular on the technical side, thorough tests have to ensure to compatibility of the solution, its integrability in the truck/ fleet management ground station, reliability in any circumstances. On the business and legal sides, the selling price and the willingness to pay of the clients, the protection of privacy, the increased responsibility of the solution provider/ fleet manager/ OEM are aspects to be studied further. Not to address other promising markets, where even better opportunities could lay (e.g. the military clients) would also be a major risk.

In the future, from the strategic business point of view, further analyses would include the following activities, building on the advantages of the IPDFM and including a business plan:

- an analysis of the structure of industrial costs,
- analysis of potential economies of scale, maturity and time to market
- the definition of the different market segments or other markets (ambulances, trains, earth-moving machines, marine, military, other vehicles) to be pursued, their specific requirements and their impact on the portfolio of products and business offers;
- scenarios or roadmaps for penetration of the market and economic return expected (ROI, NPV, IRR, DCF) and a pricing policy, as in the example provided below.

Hypothesis LOW PRICE C 30.000					Hypothesis BEST PRICE € 50.000					Hypothesis BEST PRICE € 60.000					Hypothesis BEST PRICE € 70.000				
Hp.	NPV	IRR %	PB	OK	NPV	IRR %	PB	OK	NPV	IRR %	PB	OK	NPV	IRR %	PB	OK			
8	-671.613	0,8%	5,9		233.175	15,3%	6,5	x	685.570	21,2%	5,9	x	1.137.964	26,5%	5,4	x			
10	-555.253	2,9%	7,0		349.535	16,9%	6,4	x	801.930	22,6%	5,8	x	1.254.324	27,7%	5,3	x			
12	-48.513	11,3%	7,0		1.271.676	27,7%	5,4	x	1.931.770	34,3%	4,9	x	2.591.865	40,3%	4,6	x			
14	113.891	13,6%	6,8	x	1.434.080	29,4%	5,3	x	2.094.174	35,8%	4,8	x	2.754.269	41,7%	4,5	x			
16	-1.137.484	-9,9%	7,0		-543.276	3,0%	7,0		-246.172	8,1%	6,3		50.932	12,8%	6,9				
18	-1.052.687	-7,7%	7,0		-458.479	4,5%	7,0		-161.375	9,5%	7,0		135.729	14,0%	6,7				

Table 18: Scenarios, Pricing policies and economic indicators (example)

7.11 References

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7.12 Appendix

7.12.1 “Brand” Lcv Market share from 1995 to 2004

Brand	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
FIAT	114409	137843	147882	172587	181913	203399	204503	222025	193704	199161
% on T.M.	8,8	9,6	9,5	10,4	10,3	11,0	11,3	12,6	11,2	10,6
IVECO	42441	47488	49726	51075	55327	71353	68256	65105	60078	64460
% on T.M.	3,3	3,3	3,2	3,1	3,1	3,9	3,8	3,7	3,5	3,4
PIAGGIO	7358	8016	7706	7043	6671	7342	6506	7483	6768	6619
% on T.M.	0,6	0,6	0,5	0,4	0,4	0,4	0,4	0,4	0,4	0,4
CITROEN	108307	123715	164765	163035	172835	196936	201494	188613	197360	202251
% on T.M.	8,4	8,7	10,6	9,8	9,8	10,7	11,1	10,7	11,4	10,8
PEUGEOT	78500	95405	129635	132244	149285	157132	167290	162635	162422	172007
% on T.M.	6,1	6,7	8,3	8,0	8,5	8,5	9,3	9,2	9,4	9,2
RENAULT	209183	197024	185850	218397	254985	272849	288277	287218	275305	296202
% on T.M.	16,1	13,8	11,9	13,2	14,5	14,8	15,9	16,3	15,9	15,8
TALBOT	41	1								
% on T.M.	0,0	0,0								
VOLKSWAGEN	148431	177835	203175	203751	205339	204018	186680	171822	151561	192927
% on T.M.	11,4	12,4	13,0	12,3	11,7	11,1	10,3	9,7	8,8	10,3
AUDI	808	601	480	224	510	659	1136	550	390	547
% on T.M.	0,1	0,0	0,0	0,0	0,0	0,0	0,1	0,0	0,0	0,0
SEAT	6040	25032	29216	29014	28661	31545	22634	17655	12818	4623
% on T.M.	0,5	1,8	1,9	1,8	1,6	1,7	1,3	1,0	0,7	0,2
SKODA	553	4704	9425	12460	12342	11362	1020	369	648	793
% on T.M.	0,0	0,3	0,6	0,8	0,7	0,6	0,1	0,0	0,0	0,0
BMW	145	291	246	207	295	392	382	208	155	117
% on T.M.	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
FORD	232251	226120	222376	224354	196815	175229	195448	172151	191032	206722
% on T.M.	17,9	15,8	14,3	13,5	11,2	9,5	10,8	9,8	11,0	11,0
MERCEDES	83205	122710	137273	155128	169837	171798	172242	161135	146457	158169
% su T.M.	6,4	8,6	8,8	9,4	9,6	9,3	9,5	9,1	8,5	8,4
GM	72785	73196	66595	57972	73259	76255	75062	108506	127760	140586
% on T.M.	5,6	5,1	4,3	3,5	4,2	4,1	4,2	6,2	7,4	7,5
MCC				1	1	232	365	284	283	224
% on T.M.				0,0	0,0	0,0	0,0	0,0	0,0	0,0
ROVER	39	49	957	1009	604	1007	677	277	744	300
% on T.M.	0,0	0,0	0,1	0,1	0,0	0,1	0,0	0,0	0,0	0,0
AUSTIN	5	1				1				
% on T.M.	0,0	0,0				0,0				
MINI						4		4	6	2
% on T.M.						0,0		0,0	0,0	0,0
PEGASO	2	3				149				
% on T.M.	0,0	0,0				0,0				
DAF	13472	15292	16897	15289	14871	15620	13266	10838	8883	8365
% on T.M.	1,0	1,1	1,1	0,9	0,8	0,8	0,7	0,6	0,5	0,4
SAAB	9	4	3	9	141	355	606	150	96	109
% on T.M.	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
VOLVO	1266	1295	897	589	430	635	959	235	350	687
% on T.M.	0,1	0,1	0,1	0,0	0,0	0,0	0,1	0,0	0,0	0,0
HONDA	41	15	52	486	258	127	93	81	56	28
% on T.M.	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
MITSUBISHI	29529	28141	37827	41696	46518	42282	37571	36082	37570	36249
% on T.M.	2,3	2,0	2,4	2,5	2,6	2,3	2,1	2,0	2,2	1,9
MAZDA	7985	8888	10417	10366	11165	13005	11835	8067	5683	4514
% on T.M.	0,6	0,6	0,7	0,6	0,6	0,7	0,7	0,5	0,3	0,2
DAIHATSU	3056	4197	4673	2708	2832	1784	1339	1436	861	529
% on T.M.	0,2	0,3	0,3	0,2	0,2	0,1	0,1	0,1	0,0	0,0
TOYOTA	51492	49309	50883	62138	58748	54171	42846	43568	40061	40152
% on T.M.	4,0	3,5	3,3	3,8	3,3	2,9	2,4	2,5	2,3	2,1
NISSAN	50279	48232	47707	54697	70771	75038	58428	51588	64349	80391
% on T.M.	3,9	3,4	3,1	3,3	4,0	4,1	3,2	2,9	3,7	4,3
SUBARU	2119	1748	1663	1177	315	198	110	43	83	116
% on T.M.	0,2	0,1	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,0
SUZUKI	3677	2985	2348	1254	3704	4093	3912	3552	3752	4136
% on T.M.	0,3	0,2	0,2	0,1	0,2	0,2	0,2	0,2	0,2	0,2
ISUZU	685	810	1441	1769	2256	2236	2616	3397	4332	7974
% on T.M.	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,3	0,4
HYUNDAI	11803	12882	12484	20992	21089	20907	18165	13720	10796	13021
% on T.M.	0,9	0,9	0,8	1,3	1,2	1,1	1,0	0,8	0,6	0,7
DAEWOO	15	34	21	599	2377	5124	2285	826	335	49
% on T.M.	0,0	0,0	0,0	0,0	0,1	0,3	0,1	0,0	0,0	0,0
KIA	2402	2042	2833	3997	3962	5570	4230	4654	6268	6216
% on T.M.	0,2	0,1	0,2	0,2	0,2	0,3	0,2	0,3	0,4	0,3
CHRYSLER										895
% on T.M.										0,0
VARIE USA	7872	10613	9553	7840	9974	15355	13555	13357	13202	15442
% on T.M.	0,6	0,7	0,6	0,5	0,6	0,8	0,7	0,8	0,8	0,8
LADA	14	66	58	24	10			1		
% on T.M.	0,0	0,0	0,0	0,0	0,0			0,0		
FSO	285	619	221	25	2	33	31	1		
% on T.M.	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0		
TATA	235	1351	1718	1882	1796	1662	1441	1216	617	1110
% on T.M.	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,1
ASIA					3	1			1	
% on T.M.					0,0	0,0			0,0	
Others Eastern Europe	452	30	1			1	2		2	15
% on T.M.	0,0	0,0	0,0			0,0	0,0		0,0	0,0
Others	5455	110	151	165	186	2794	2243	3297	5019	6211
% on T.M.	0,4	0,0	0,0	0,0	0,0	0,2	0,1	0,2	0,3	0,3
TOTAL MARKET	1296649	1428699	1557156	1656203	1760087	1842662	1807533	1762262	1729925	1866024

7.12.2 European light commercial vehicles (LCV) per segment

Segment PU		Segment 1A		Segment 1B	
Fiat Strada 	Mitsubishi L200 	Fiat Panda Van 	Renault Clio Van 	Fiat Doblo Cargo 	VW Caddy 
Toyota Hilux 	Nissan King Cab 	Peugeot 206 Van 	Ford Fiesta Van 	Renault Kangoo 	Citroen C15 
Segment 2P			Segment 2G		
Fiat Scudo 	Citroen Jumpy 	GM Vivaro 	Citroen Jumper 	Mercedes Sprinter 	Iveco Daily 
Renault Traffic 	VW Transporter 	Mercedes Vito 	Fiat Ducato 	Peugeot Boxer 	

7.12.3 Us Trucks per segment

Segment Medium duty Truck

Chevrolet Silverado 2500/3500 HD 	Dodge Ram 2500/3500 Regular/Quad Cab 
GMC Sierra 2500/3500 HD 	Ford F-250/F-350 XL 

Segment Other Passenger trucks

Chevrolet Express 	Dodge Sprinter Van 	Ford E-Series 
GMC Savana G2500/G3500 	HUMMER H1 	

7.12.4 Onstar: the interface

