Project overview

LIFECYCLE EXTENSION THROUGH PRODUCT REDESIGN AND REPAIR, RENOVATION, REUSE, RECYCLE STRATEGIES FOR USAGE&REUSAGE-ORIENTED BUSINESS MODELS

T-REX Consotium

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Project overview

Management and planning

Project Characteristics -under G.A.-

- Project title: ***"Lifecycle Extension through Product Redesign and Repair, Renovation, Reuse, Recycle Strategies for Usage&Reusage-oriented Business Models"***
- Acronym: T-REX
- Contract number with EC: 609005
- Entry into force of the contract: 2nd July 2013
- Project start date: 1st October 2013
- Duration: 36 months
- Overall budget: **5,126,411.00 €**
- 2 reporting periods:
  - → Period 1: From month 1 to month 18
  - → Period 2: From month 18 to end of the project

Concept

	"traditional" business model	New business model
Product design	- Product is designed for the minimum cost	- Product cost is less important. The relevant is the **Total Cost of Ownership**. - The product is configured for the application.
	- Lifetime should be "enough"	- Product **lifetime is enlarged**.
Services, supply chain and customer relationships	- Product developer establishes conservative preventive maintenance policies. Maintenance is made "in house" or third parties	- Product developer make extra effort to minimize maintenance cost: leveraging on techniques and tools to optimise preventive and **emphasize on prediction**
	- After-sales services, mainly technical assistance and spare parts, are sources of revenue for the manufacturer (or third parties)	- Services allow to **increase** the product **availability**
Customer relations and Cash flows	- Product sales as a one-off transaction	- Product-service system provision as a relational, **long-term process**
	- In the usage and end-of-life phase interactions between the manufacturer and the customer may not occur - If they occur their monetary value is often negligible compared with the product value	- **Stable and continuous cash flows from** customer to manufacturer over the product life-cycle, of a smaller entity compared to product sales - Cash flows cover both **the product and service** component of the offer
	- Product developer is not aware of the conditions in which the product is in operation	- Product developer is **aware of operating conditions** - Information from the product is collected to **increase** product **availability** (e.g. condition based monitoring), increase **service efficiency** (e.g. remote control) **and** transform the **feedback** from the field in input **to** the **design** of product and services
	- Dismantling is in charge of the user	- **End of life is in charge of the producer. Some modules could be re-used**

S&T Objectives

- Develop and prototype, through three business application cases, a business platform for the offering of capital goods whose main elements are:
  i. A business model oriented to transfer the access of the goods (the Product Service System) to the customer rather than the ownership (e.g. through renting).
  ii. An improved design of the product and of its core systems, aimed at extending the lifecycle of the critical components, and to ease maintenance.
  iii. A re-engineering of traditional (support) services and the definition of new services
- Industrial objectives:
  i. Reduce operational maintenance service cost by 15%-30%;
  ii. Re-use components for 55-70% depending on the product, and;
  iii. Extend the life cycle of 30% - 80% depending on the product or components.

  ➔ All of these contribute to reductions in the **Life Cycle Cost** in the range of 25-30%.

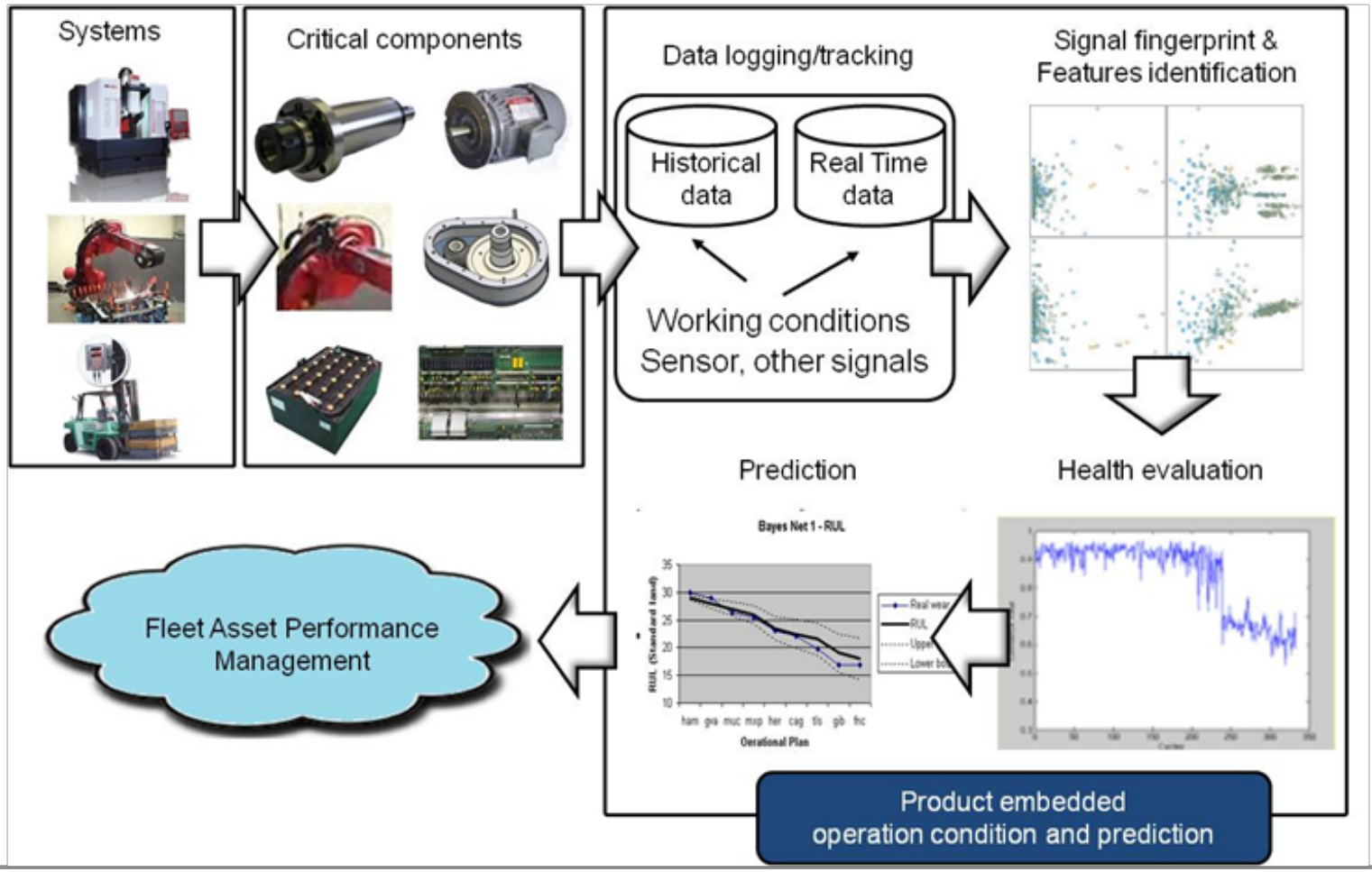
Lever A. Business models

- New business model will be adopted, with the aim:
  1) of translating strategies into actions;
  2) of identifying the elements that can make the company move to an higher degree of “servitization” of the business
- The development of a maturity model will be helpful
  - From a conceptual side, it will clarify what are the elements that determine the ability of a firm to actually deploy a “usage-oriented” business model (e.g,. organisational approach, resources, performance management practices, relations with customers and suppliers).
  - From a practical side it will allow companies to understand their position and identify the set of actions to be undertaken and how to do it.
  - It will also support standardisation activities.
- This will be done at a conceptual/general level, and with specific reference to the business cases.

Lever B. Product design for X (re-use, serviceability,...)

Domain	Product evolution & Re-used modules	Operation conditions	Source of equipment faults
Transport and manipulation	• Fork and must dimensions • **Battery** • Motors • Counterweight • Security components • Hydraulic cilinders • Remote control, navigation system • Ergonomics components	• Loads • Speed • Distances • Collisions • Battery stress • Battery load cycles	• Battery • Motors (starter, alternator) • Brakes • Chain • Electronic boards
Machining processes	• CNC/PLC • Spindle • Mechanical axes (nut, screw, bearings, etc.) • Motors • Monitoring devices • Hydraulics	• Spindle speed, load • Tools • Temperature • Refrigeration • Power consumption	• Spindle • Axes • Motors • Electronic boards
Robotised assembly	• Robot area of work, volume • Gripper/Tool • Welding module • Gearbox • Motors • Monitoring devices • Handling, working tables, fixturing elements • Fences and other security comp.	• Payload • Motor activity • End of arm tool changes • Calibration procedure • Power consumption	• Gearbox • Motors • Control, unbalanced phase, payload excess • End of arm tooling • Electronic boards

Lever C. Embedded condition monitoring and prediction



Lever D. Asset Health Management. 'Fleet' Management

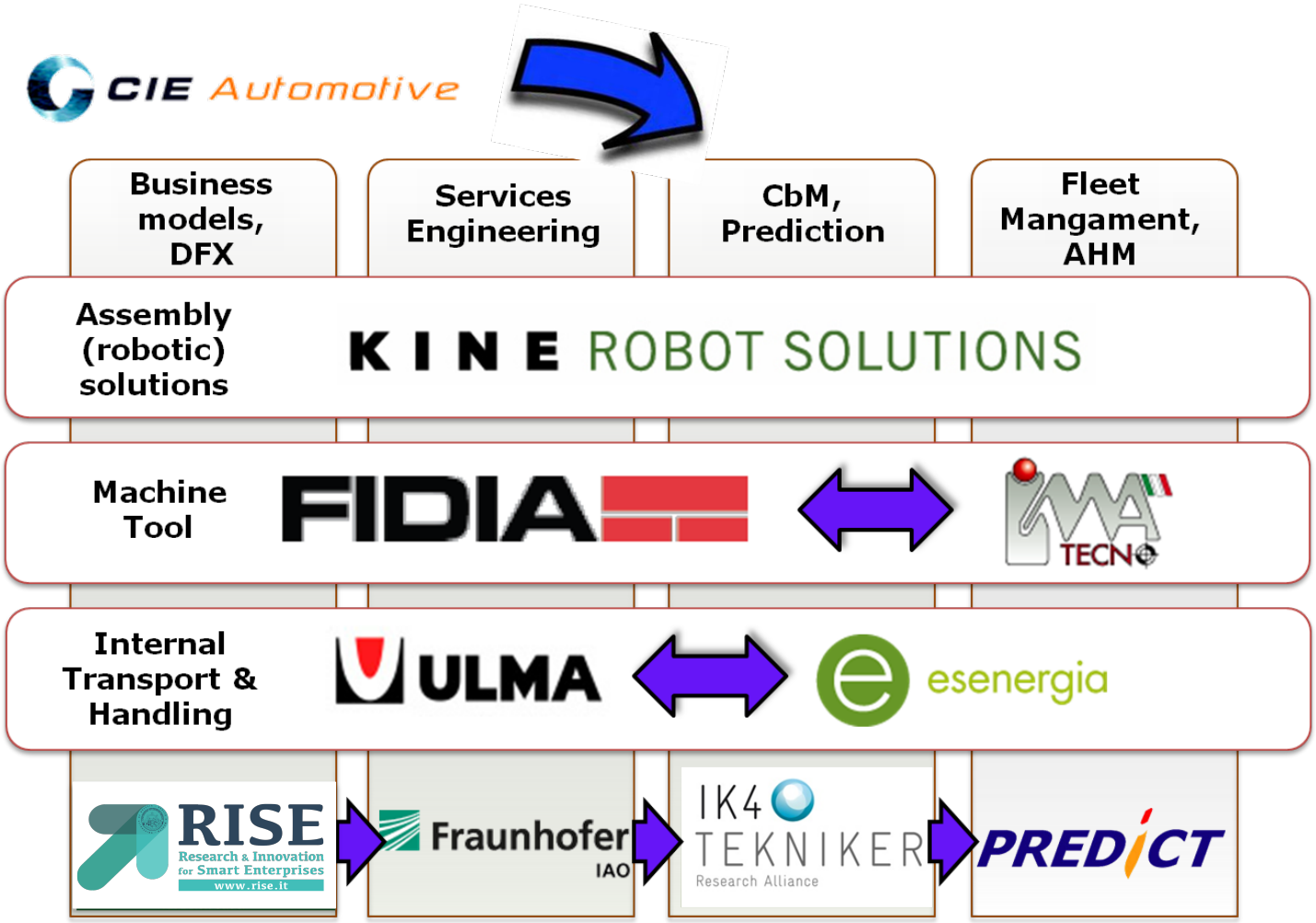
Tool for Asset Health Management (customized on the requirements of the business case):

- To collect information from the equipment installed base
- Support an optimized planning of maintenance activities, thus reducing the lifecycle cost of the product.

Lever E. Service Engineering

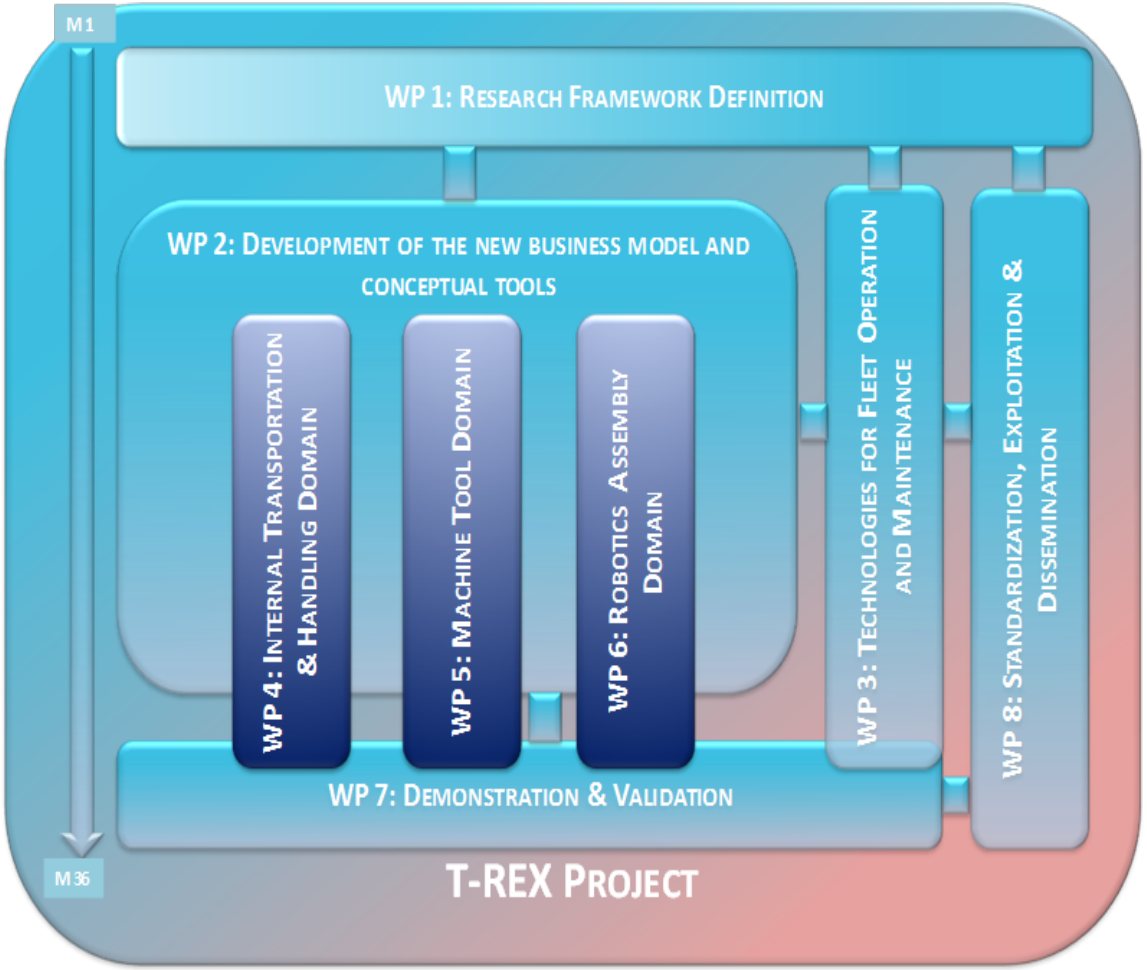
- Identification of relevant product-related services that support the extension of product lifecycles
- Development of a methodology to describe product-related services in a standardised way (including outcome, processes, resources, customer interfaces e.g.), or “reference model”
- Development of a methodology to create service modules that allows a flexible bundling and configuration of product-related services
- Provision of a model for a rapid development of new services including configurable processes, task descriptions, methods and roles
- Extension of the model for rapid service development in order to integrate new product and service development processes
- Development of a self-assessment tool. i.e. the results of the study will be transferred to a database and via an online interface further companies could fill in the same questionnaire than in the study and as a response they will get the individual results of the study and their own position about their service design capabilities

Partnership



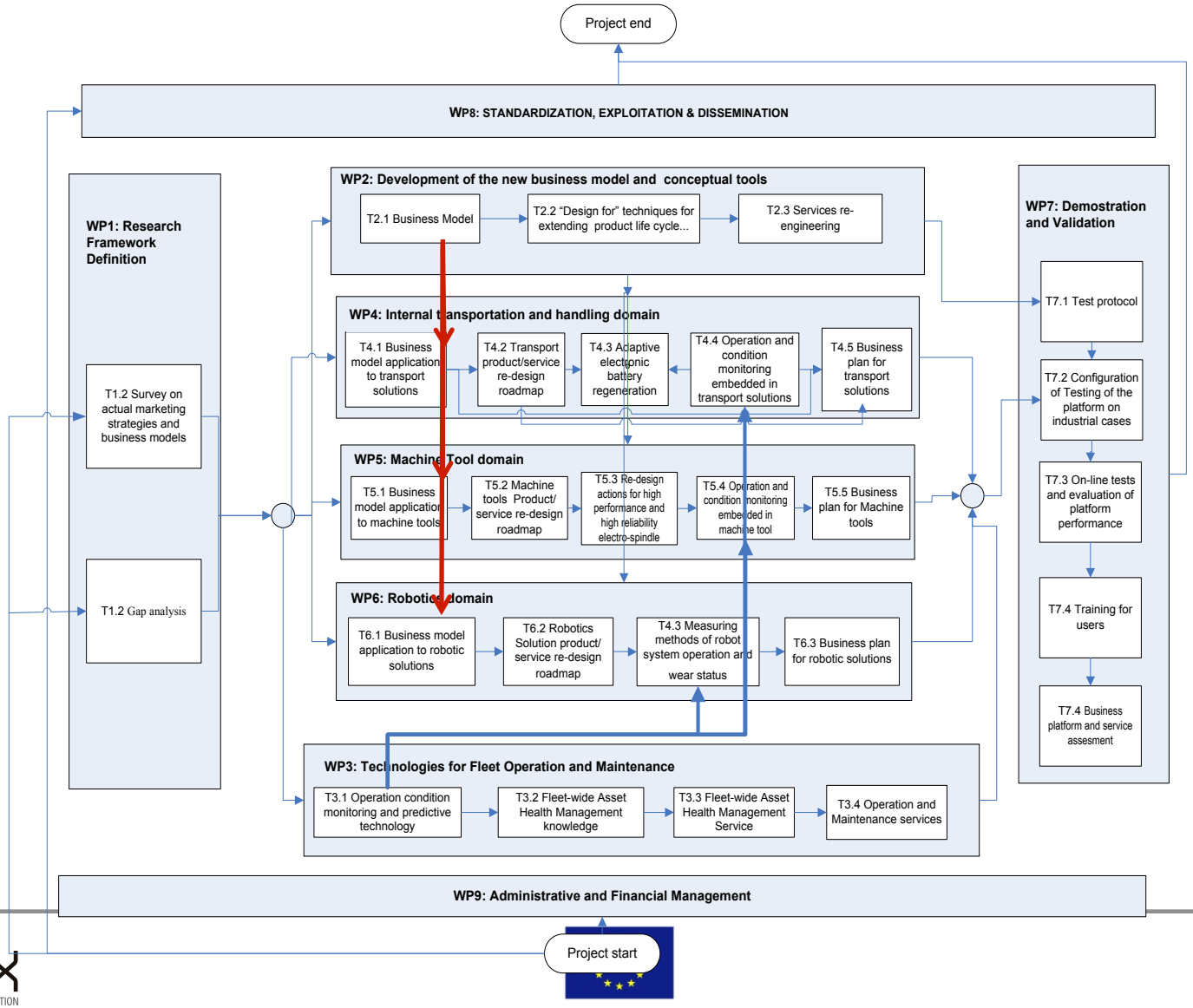
Overall strategy

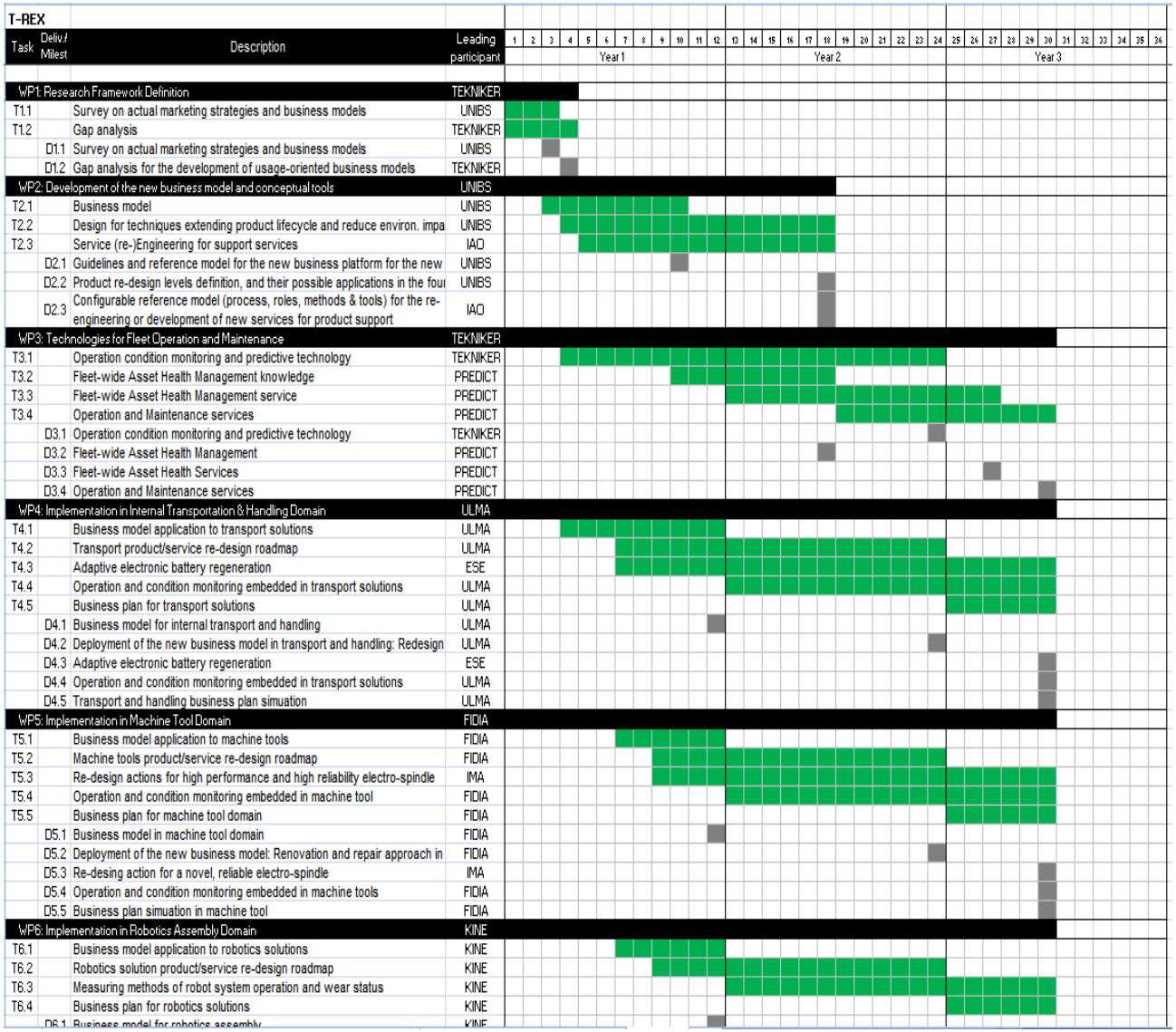
1st Oct. 2013



30th Sept. 2016

Detailed planning





T-REX Task	Deliv./ Milest	Description	Leading participant
WP1: Research Framework Definition			TEKNIKER
T1.1		Survey on actual marketing strategies and business models	UNIBS
T1.2		Gap analysis	TEKNIKER
	D1.1	Survey on actual marketing strategies and business models	UNIBS
	D1.2	Gap analysis for the development of usage-oriented business models	TEKNIKER
WP2: Development of the new business model and conceptual tools			UNIBS
T2.1		Business model	UNIBS
T2.2		Design for techniques extending product lifecycle and reduce environ. impa	UNIBS
T2.3		Service (re-)Engineering for support services	IAO
	D2.1	Guidelines and reference model for the new business platform for the new	UNIBS
	D2.2	Product re-design levels definition, and their possible applications in the four	UNIBS
	D2.3	Configurable reference model (process, roles, methods & tools) for the re-engineering or development of new services for product support	IAO
WP3: Technologies for Fleet Operation and Maintenance			TEKNIKER
T3.1		Operation condition monitoring and predictive technology	TEKNIKER
T3.2		Fleet-wide Asset Health Management knowledge	PREDICT
T3.3		Fleet-wide Asset Health Management service	PREDICT
T3.4		Operation and Maintenance services	PREDICT
	D3.1	Operation condition monitoring and predictive technology	TEKNIKER
	D3.2	Fleet-wide Asset Health Management	PREDICT
	D3.3	Fleet-wide Asset Health Services	PREDICT
	D3.4	Operation and Maintenance services	PREDICT
WP4: Implementation in Internal Transportation & Handling Domain			ULMA
T4.1		Business model application to transport solutions	ULMA
T4.2		Transport product/service re-design roadmap	ULMA
T4.3		Adaptive electronic battery regeneration	ESE
T4.4		Operation and condition monitoring embedded in transport solutions	ULMA
T4.5		Business plan for transport solutions	ULMA
	D4.1	Business model for internal transport and handling	ULMA
	D4.2	Deployment of the new business model in transport and handling: Redesign	ULMA
	D4.3	Adaptive electronic battery regeneration	ESE
	D4.4	Operation and condition monitoring embedded in transport solutions	ULMA
	D4.5	Transport and handling business plan simuation	ULMA
WP5: Implementation in Machine Tool Domain			FIDIA
T5.1		Business model application to machine tools	FIDIA
T5.2		Machine tools product/service re-design roadmap	FIDIA
T5.3		Re-design actions for high performance and high reliability electro-spindle	IMA
T5.4		Operation and condition monitoring embedded in machine tool	FIDIA
T5.5		Business plan for machine tool domain	FIDIA
	D5.1	Business model in machine tool domain	FIDIA
	D5.2	Deployment of the new business model: Renovation and repair approach in	FIDIA
	D5.3	Re-desing action for a novel, reliable electro-spindle	IMA
	D5.4	Operation and condition monitoring embedded in machine tools	FIDIA
	D5.5	Business plan simuation in machine tool	FIDIA
WP6: Implementation in Robotics Assembly Domain			KINE
T6.1		Business model application to robotics solutions	KINE
T6.2		Robotics solution product/service re-design roadmap	KINE
T6.3		Measuring methods of robot system operation and wear status	KINE
T6.4		Business plan for robotics solutions	KINE
	D6.1	Business model for robotics assembly	KINE

Milestones

Table 1.3 c: List of milestones				
Milestone number	**Milestone name**	**Work Package(s) involved**	**Expected date[1]**	**Assessment Criteria/Means of verification[2]**
M 1	Consistency amongst the designed Research Framework and the Contract Technical Documents	**WP1**	M 5	Reserach Framework defined, gaps identified and business models already referenced .
M 2	The Technologies and the Tools prepared have been suitable for Implementation	**WP2**, WP3, WP4, WP5, WP6	M 18	Life cycle extent and Pay4Use concepts developped and new business models already defined in the three application domains. Fleet-wide Asset Health Management established.
M 3	The Technologies and the Tools prepared have been suitable for Implementation in diverse environments	**WP3, WP4, WP5, WP6, WP7, WP8**	M 36	The demonstrators run smoothly without major adjustments in tools. T-REX results validation done.

T-REX Consortium

IK4 TEKNIKER
Research Alliance

PREDICT

KINE ROBOT SOLUTIONS

ULMA
Carretillas Elevadoras

FIDIA

CIE Automotive

esenergia

IMA TECNO
MECHANICAL TECHNOLOGIES

Fraunhofer
IAO

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