Title:	A Reconfigurable robot workCell for fast set-up of automated assembly processes in SMEs
Acronym:	**ReconCell**
Type of Action:	Innovation Action
Contract Number:	680431
Starting Date:	1-11-2015
Ending Date:	31-10-2018

Deliverable Number:	D5.2
Deliverable Title:	Technical report on ReconCell model for business intelligence, part 2
Type (Public, Restricted, Confidential):	Restricted
Authors:	Kai Salminen, Harri Kuusela, Rune Larsen, Shahab Parizi, Franziska Kirstein, Christian Schlette,
Contributing Partners:	Hermia, JSI, BOR, MMI, ELVEZ, LDT, PRZM

Estimated Date of Delivery to the EC:
Actual Date of Delivery to the EC: 16-11-2017

Executive Summary

Technical report on ReconCell model for business intelligence, part 2 covers the progress made on ReconCell business intelligence (BI), business model (BM), related system implementation. It describes the status of integration of BI system with business assessment and system design approach. It also describes current test setup of Product Service System (PSS) and preparation for the additional use cases.

WP 5 is concerned with planning and implementing a business intelligence solution to support shared ReconCell Business Model (BM) of ReconCell network for system delivery. The envisioned ReconCell Business Model (BM) consists of two operative layers; ReconCell ltd business layer and ReconCell Systems Delivery layer. The product and service model (PSS) of ReconCell as systems delivery is to provide a robot based reconfigurable autonomous assembly system with supporting life-cycle services as ReconCell Ltd as a business unit with a business network consisting of several collaborating partners providing the product and services upon shared contract.

This document describes the status of business model (BM) development and implementation, related business intelligence (BI) buildup and the corresponding set-up of business intelligence tools and integration solutions that supports it. It provides also the background and motivation for used approaches and selected tools as synthesis of the ongoing workshop-based development done by ReconCell business team and its task-groups, industrial cases and included collaborative partners.

Integration issues with other Work Packages and ReconCell business environment as whole are also discussed and solution approach status is presented. This report provides the initial Business Intelligence (Bi) integration approach and description of ongoing implementation status, and the chosen concepts. The preparations for the two- layer product service system (PSS) business model (BM) of ReconCell Inc and related ReconCell system implementations are used for planning the approach for including the new additional test cases. The recommendations of evaluators are taken on account and the approach is revised accordingly.

The task is carried out by ReconCell Business Team and supported by all partners of this task.

Contributors

Blue Ocean Robotics Ltd	Rune K. Larsen, Partner & Co-CEO Shahab Parizi, Business Developer Franziska Kirstein, Human-Robot Interaction Expert
Hermia Group	Kai Salminen, Program Manager Harri Kuusela, Program Director Kasperi Jakonen, Research assistant
Josef Stefan Institute IJS:	Dr. Igor Kovač
SDU/RWTH Aachen University/	Dr.-Ing. Christian Schlette, principal investigator and head of the group “Industry” Dipl.-Inform. Daniel Losch, Research Assistant

Table of Contents

Used Terminology

ADOxx.	Development platform, meta-modelling development platform for implementing modelling tools
ADONIS	Commercial Business Process Management and Notation (PBMN) toolkit based on ADOxx.
BM	Business Model (BM); BM has two parts: “Part one (organizing) includes all the activities associated with making something: designing it, purchasing raw materials, manufacturing, and so on. Part two (functional) includes all the activities associated with selling something: finding and reaching customers, transacting a sale, distributing the product, or delivering the service.
BM Canvas	Business Model Canvas is an organized way to lay out your assumptions about not only the key resources and key activities of your value chain, but also your value proposition, customer relationships, channels, customer segments, cost structures, and revenue streams.
PSS	Product Service System (PSS) a business model that consist of tangible products and intangible services designed and combined for jointly fulfilling specific customer needs.
Requirement	Requirement (1) A condition or capability needed by a user to solve a problem or achieve an objective. (2) A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed documents. (3) A documented representation of a condition or capability as in (1) or (2). (IEEE Std 610.12. 1990)
RE	Requirement Engineering. Activities that cover discovering, analyzing, documenting and maintaining a set of requirements for a system.
SoS	SoS is ‘a collection of task-oriented or dedicated systems that pool their resources and capabilities together to obtain a new, more complex ‘meta-system’ which offers more functionality and performance than simply the sum of the constituent systems”. (Popper 2004)

.

WP5 Business Intelligence

Introduction

ReconCell project sets to answer the market oriented demand of fast re-configurable assembly systems for SMEs. ReconCell as a system is an easy to (re-)configure and (re-) programmable work cell concept for assembly and related supporting life-cycle service platforms. The approach is envisioned to make robot based assembly solution economically and strategically viable in a fast changing business environment for manufacturing SMEs.

ReconCell aims at allowing easy access for SMEs to automated assembly and reduction of integration effort, cost and time related to implementation. ReconCell seeks also to constantly improve customer process quality by offering the users latest technology and research allowing them to use the latest vision and sensory systems and provide fast response time for system changes using latest virtual twin approaches as service. Costs of the hardware, software adaptation and system integration are reduced by efficient system and service modularization, process based knowledge sharing and continuous benchmarking between delivered systems. ReconCell idea is based on efficient reuse and sharing of best resources within an expanding resource pool. This is planned to be achieved by introducing a networked modern business model that allows fast collaboration based on constant solving of end-user needs in an agile cross border rapid response environment.

ReconCell Product Service System (PSS) business model idea is described in detail in deliverable D5.1. The development and implementation are done by business team as an action learning process involving continuous study on each demonstration and use cases. The use-case base will be further expanded through an open call.

ReconCell has four different use-cases with different profiles;

- Case Elvez that represents a SME within contract assembly business of volume products and with own line development and integration resources for life-cycle services,
- Case Logicdata that represents a networked SME with own product design of standardized products and own process development resources. They are outsourcing their order based small batch production and assembly.
- Case Prezisika Precizika Metal that represents a SME within small batch and one-of-a -kind product business with own product development resources and assembly line.
- Case Blue Ocean Robotics that represents a one- stop- shop for Reconcell ltd and access to the product and services along to chosen PSS model.

Both Elvez and Prezisika Precizika Metal are also planned to provide their resources for ReconCell Ltd.

Business team

ReconCell Business Model and the supporting environment are being (or leave it out) developed by an internally established "business team" consisting of Hermia, MMI, JSI, SDU and BOR. This "business team" is responsible for defining and developing the envisioned Product Service System (PSS). The envisioned support system consisting of Business Assessment Tool (Inhancer), Business Intelligence (BI) and VEROSIM modules and is intended to support decision making in marketing, sales, implementation, use and services phases.

WP5 Business Intelligence is a collaborative effort of the ReconCell “Business team”; Hermia, MMI, BOR and JSI and industrial cases LDT, ELVEZ, and PRZM. Its main responsibility is to develop the business model and integrated platform that can support it.

WP5 progress in Business Intelligence (BI) four tasks:

5.1 Business requirements synthesis, (Intention-based Business Model): details about the strategic and operative demands derived from real industrial cases. The first part of it has been completed and the next phase concentrates on the development of requirement engineering (RE) approach for open call to be organized in November 2017.

5.2 Business model (BM) implementation. This task implements the chosen approaches and tools, tests and verifies them. Integration is done using a business landscaping approach described in detail in this report.

5.3 Intelligent use of business model: this task concentrates on the use of the developed system and on setting-up a knowledge model.

5.4 Standards and state of the art benchmarking (Development): this task seeks to ensure efficient use of the most current standards. This task is planned to be run over the whole project period.

The evaluation of the first part of the project stressed that the consortium needs to shift focus from the current envisioned business plan idea that includes the whole spectrum of possibilities to what is realistic and achievable for the first phase of commercialization. The complete business plan derived from partners possibilities include plans to sell an off-the-shelf product (assembly system module) with a complete product-service system (PSS) and offering production capacity on contract base.

Evaluators pointed out that first business offers should carefully select the system components and processes that have adequate maturity. Therefore, we have selected to proceed with core processes and pay attention to maturity issues/level. The reviewers also appreciated the used workshop approach to customers to collect early end-user input and we have further enhanced this approach and focused on understanding the needs of the SMEs better for future exploitation of the project’s results.

First phase Business model

ReconCell project has decided to use Product Service System (PSS) as described in D5.1. According to the recommendations by reviewers our business team has planned a three-step approach for introducing the business model and related business process modelling (BPM) to ensure concentrated advancement with enough maturity towards commercialization of the results.

1. Step 1; basic business processes for marketing, sales and delivery and interacting new product design (NPD) process
2. Step 2; basic processes for administrative and quality based management for ReconCell ltd
3. Step 3; basic customer life cycle support service processes.

The first implementation concentrates on Step 1 and the basic offering and those processes delivering it.

Business Intelligence implementation

ReconCell is envisioned as a process organization where the overarching processes combine the partner resources for common shared goal. Processes are described in figure 1 and process map figure 4. Within the process map, there are described core processes (CP) and activities, customers, subcontractors and their interdependencies. Main processes are further divided into sub-processes that describe individual tasks.

Business Intelligence implementation covers the description of the business processes, systems, tools and service approaches available and business process control approach.

Business Intelligence (BI) covers the processes for:

Step 1; Orchestration of the business processes for basic delivery and system design.

Step 2; Requirement Engineering (RE) for integration of customer needs with offering. Business assessment is integrated with RE to create the intention document that translate customer needs to process tasks with relevant Objectives and Key Results (OKR) and related sets of corresponding performance metrics (Key Performance Indicators (KPI)).

Step 3; Integration of the business processes with system design. Integration of the RE with design environment. Customer requirements, partner processes and system requirements integrate for implementation planning processes using statistical and predictive analytics.

Step 4; Intelligent use of implemented solutions by providing data visualization and supporting life-cycle collaboration by sharing data, information and knowledge.

Step 5; Knowledge Management Process (KM) for learning and process based knowledge creation, sharing and re-use.

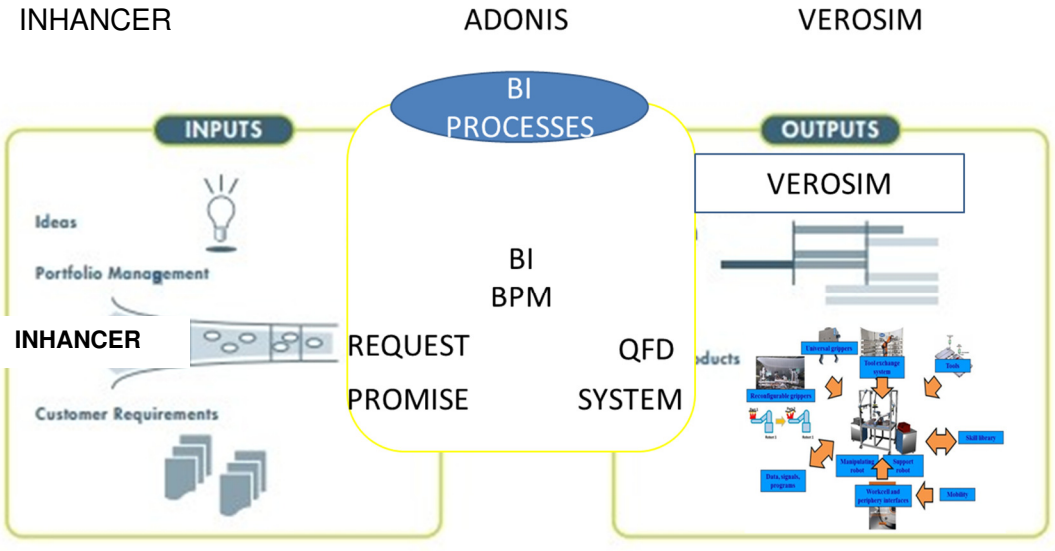


Figure 1 Framework Integrating customer and offering using integrated approach

Key processes are organization of resources, administration, sales and delivery, development and configuration of new systems (NPD), management, service and control of systems in use. In the first

phase, it is essential to concentrate on two key processes that define business success; New Product Design (NPD) and marketing, sales and delivery process.

Strategic business design for ReconCell is done using strategic landscaping (CSL). A generic CSL framework in (Figure 2) presents the main elements of a strategic business environment that relate to the product and service structuring and design of the processes. The aim is that the rationalization of product/ service and process variety are presented by CSL framework that allows continuous discussion and dynamic defining of the product and services and the extent of re-configurability demand in relation to customer request. The target setting done by the business team in a workshop with a multi-disciplinary group of participants from the consortium was to continuously broaden understanding of the drivers for decisions, and the voice of different functions and customer requirements can be heard. All specific targets might not be relevant to all the participants in the strategic workshops. Despite this, acknowledgement of these aspects and following the workshop on target setting increase understanding for the overall decision making related to necessary product/service range.

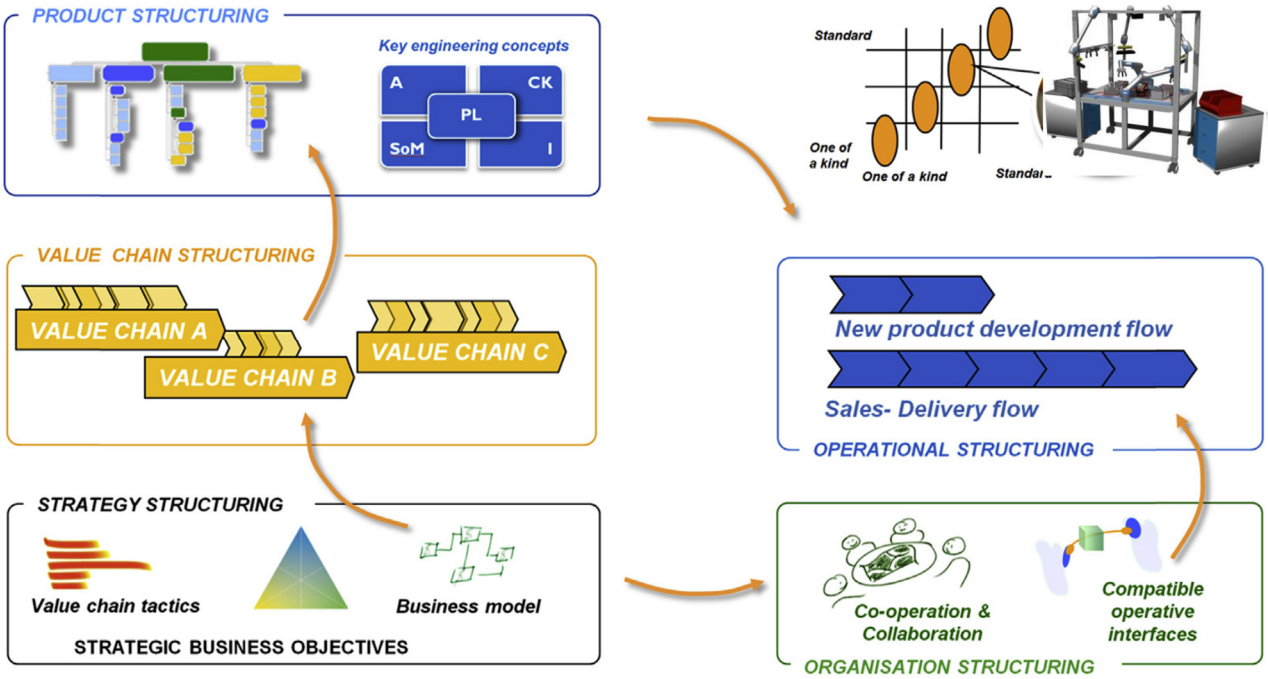


Figure 2 Company Strategic Landscaping (CSL) framework and method for creating operational structure of ReconCell. (Lehtonen 2007)

Strategic business objectives, value chain structuring and product and service structuring build the basis for operational structure of the basic processes. The goal is to create, agree and describe core processes; New Product Development (NPD) process, sales, order-to-delivery process and support processes for life cycle phases. They are based on agreed value chains the company wants to operate in and strategy and organisational aspects that influence product and service structuring, and to define the targets according to these viewpoints. The targets arise from several life phases of the product and service from the different functions of the network.

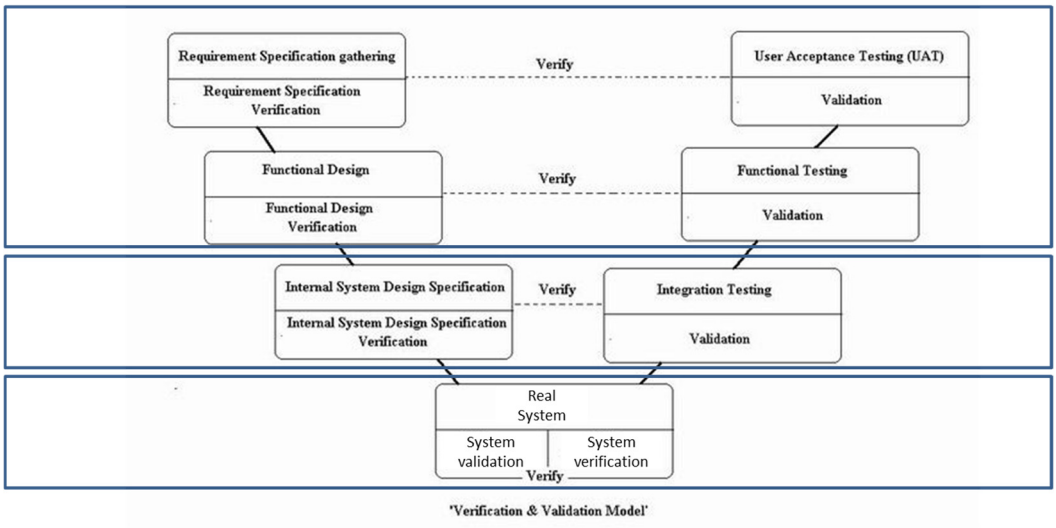


Figure 3 System Design Management as process basis, V-Model

The Systems Engineering (SE) is the core of ReconCell. It is the process by which a customer's needs are satisfied through the conceptualization, design, modelling, testing, implementation, and operation of a working system. The SE covers basic delivery; an assembly system, material flow system and quality assurance system as modules and can be expanded to include services like turn-key line integration, line planning, monitoring, analysis, maintenance and re-configurability services.

An important aspect of Systems Engineering is that the perspectives of seven critical stakeholders (i.e., user, acquirer, developer, tester, trainer, sustainer, and researcher) are considered throughout process. These seven, essentially peer, stakeholders are always included in processes that purport to modify, improve, or otherwise streamline the development processes.

ReconCell is by nature a RMS (reconfigurable Manufacturing System) that has System of Systems (SoS) features (Maier (1996)) and has thus from a business point of view five characteristics that distinguish it from complex monolithic systems like FMS:

1. Operational Independence of the Elements (modules and services): ReconCell structure has modules that if disassembled are still able to operate independently in a useful manner, and all the modules are not needed for basic functionalities. For instance, vision system is not always needed but can be included for added functionality. Vision system can also act as a separate quality check function.
2. Managerial Independence of the Elements: Component systems are separately acquired and continue to be managed independently. The ReconCell consortium has partners specializing on specific components and services
3. Evolutionary Development: The delivered ReconCell system evolves over time, with component systems capabilities added, removed, or modified as needs change and experience is gained.
4. Emergent Behavior: The ReconCell delivery has emergent capabilities and properties that do not reside in the component systems. These capabilities that are essential to customers can be verified by simulations and life-cycle analysis as service.

5. Geographic Distribution: Some of ReconCell component systems, like simulation service, are geographically distributed but have the ability to readily exchange information.

This SoS nature has effect on the way the business processes need to be planned. For planning the New Product Development and order- to-sales processes two central perspectives are needed

1. Capability oriented perspective for NPD and order-to -delivery processes: This first perspective relates to the overall process for establishing new capabilities via NPD process with continuing evolution over the ReconCell life cycle as the needs and opportunities for delivering new capabilities arise.
2. “Connecting the Parts” oriented perspective: The second perspective recognizes that the ReconCell is built from a collection of independently acquired modules and operating systems that must now be connected. Therefore, there must be specific mechanisms that allow the component systems to come together.

The equivalent consistent Requirement Engineering (RE) approach for the system management will be the base of business solution along the lines of new ISO 16355-5:2017 that describes the process of developing a solution strategy for new products (https://www.iso.org/standard/62633.html).

The development of the processes will be done parallel of the use-case deliveries engaging all stakeholders (users, developers, the acquisition community, testers, trainers, sustainment/logistics experts, and system level researchers) at an early stage in the eventual development and deployment. Collectively they provide input that guides development of the primary products and services.

Experimentation and early deployment addresses all the stakeholder interests. For example, with adequate training and coordination initial capability can be verified. Good NPD have a vital role in ensuring that system development pays heed to component “-ilities”: availability, serviceability, upgradeability, and so forth.

Output products of the field experimentation are user validation, initial operational capability, and test of the business model. A primary focus of the entire experimentation process is to generate user enthusiasm that translates into improved user requirements for the total ReconCell capability. Test cases provide confirmation of value for the ReconCell community and users and validates concepts and generates users requirements.

Test cases also provide quick operational capability and test-bed for further experimentation. A third product is an updated user-driven requirements document that can feed a standard SE process for individual system upgrades.

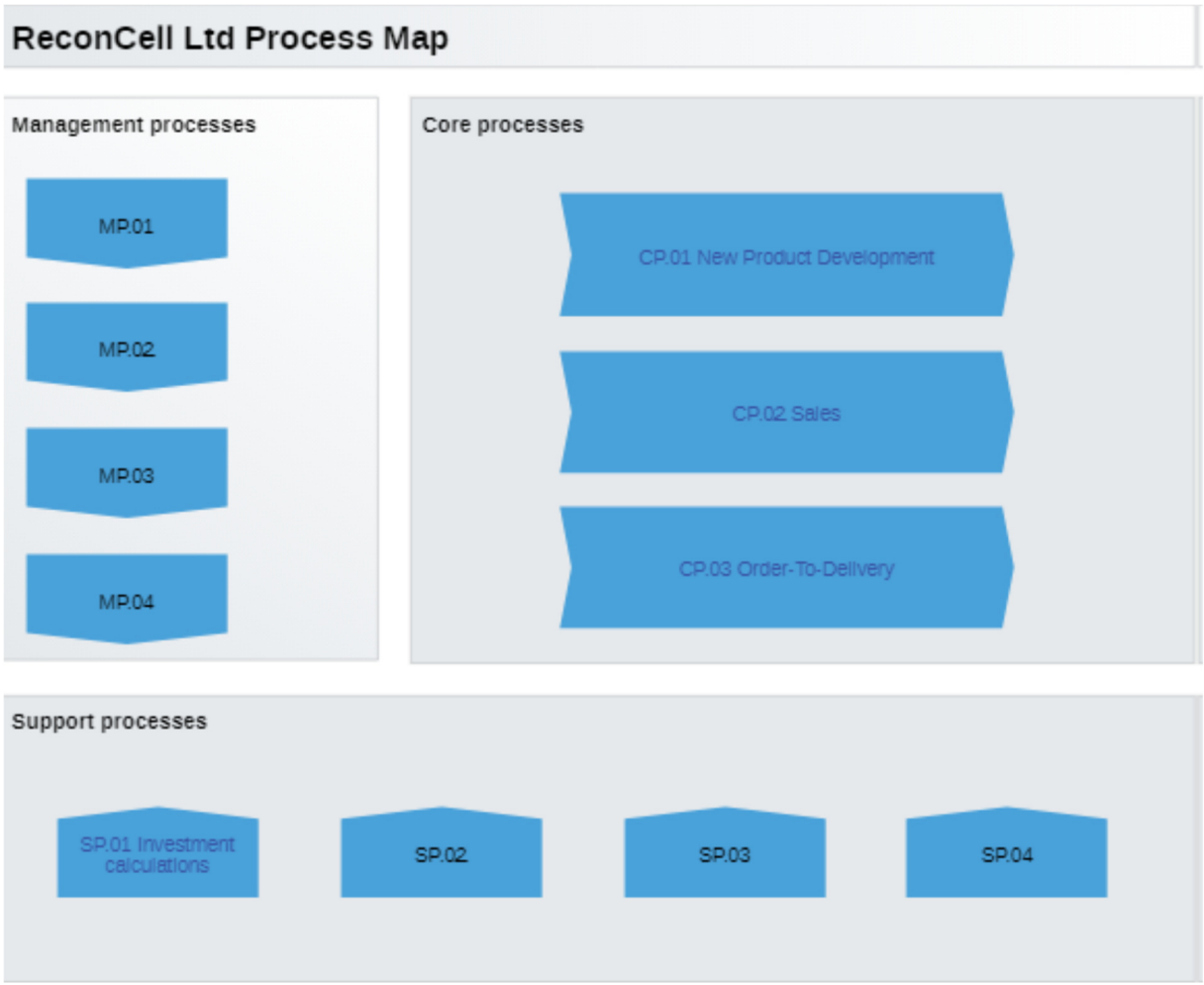


Figure 4. ReconCell Ltd level Process Map

In the ReconCell Ltd Process Map, step 1 is to build for orchestrating necessary actions for test cases over the ReconCell network. The first stage management processes cover four core processes; administration, sales and delivery, product design and support processes. Core processes for test cases are; Product process, New Process Development (NPD), marketing and sales and order-to-delivery. Support processes cover analysis processes like invest calculations, competitor analysis, benchmarking and voice-of-the customer.

ReconCell implementation as dynamic network of business processes

The challenge for ReconCell from business process point of view is a dynamic complex network of very different, geographically separated partners that have different roles and competencies. Networks consisting of research, system delivery and end-user type of companies with different goals and interests need to be integrated in a life-cycle based business model. Integrating their relevant processes in a meaningful way as one mutually agreed business platform calls for careful planning.

In Step 1 model the central integration partner takes the commercial responsibility of the main business, administration, product and services delivery and life-cycle services while the other partners offer their specialized services in various roles from subcontractors to research partners.

The ReconCell project aims at creating eventually a complex dynamic scalable business system of ReconCell Ltd that would be capable of planning, delivering and maintaining credibly a product and

related service. The basic product would be an autonomous robot based collaborative re-configurable ReconCell System of Systems (SoS) type RMS (Reconfigurable Manufacturing System) solution for assembly processes.

To cope with fast response and resiliency requirements of markets the envisioned ReconCell Ltd needs an agile adaptation platform that is collaborating with each partner, customers and delivered system and an equivalent Requirement Engineering (RE) solution. The envisioned approach consists of integration of Inhancer, Adonis and Verosim tools and processes as shared modules to allow for verifying the chosen model based collaborative approach for PSS.

The ReconCell Product Service System (PSS) idea aims at an agile integrated problem-solving network that provides a dynamic product and service portfolio for rapid collaborative configuration and reconfiguration of delivered assembly cell. It works as open networked system joining needed resources on point of need. It supports customers by solving assembly related problem as service by providing system components, knowledge and support services like simulations, concept planning, implementation support, maintenance and training.

The basic business processes providing these products and services are the process knowledge. Processes are planned modeled and tested for efficient reuse to allow agile resilient service and efficient collaboration of partners.

ReconCell business processes management (PBM) implementation

The ReconCell business process management (BPM) implementation Step 1 is to cover the basic processes needed to integrate customers and the business process with pre-prepared product model and basic services from the network.

Basic processes of ReconCell PSS implementation concentrate on functionalities and approaches to integrate customer to business process that provide for product, design services, delivery and installation, ramp-up and validation;

1. Customer contact and Requirement Engineering. Using Business Assessment Tool (Inhancer) we have identified and contacted the potential customer base. Sales- and delivery process is based on the necessary tasks to formulate the base for intention documentation.
2. Intention forming. Intention is the base document describing the customer's need as request. Intention documentation describes functional business based needs to be reflected with configuration possibilities (request => promise= concept, model and acceptance testing) for strategic decision making for management.
3. Integration of concept design with delivery and implementation process design; system design and configuration upon customer need (intention-based concepts and organization of resources for implementation). This task will be completed and tested using real implementation processes as model and at the same time will establish the consortia structure for first deliveries.

Basic processes cover intention process connecting business functional needs with concept design (Request- Promise, Concept- Acceptance). The envisioned Intention process provides for synthesis on needs and possibilities using process knowledge.

Test implementation for Step 1

ReconCell Ltd BI implementation Step 1 for test environment functions as a process organization. The organization is set of interlinked processes that combine different partners' resources for one goal. For agile systems delivery and re-configuration ReconCell integrates three basic interconnected process models; Business process, Design process and Manufacturing and system delivery process.

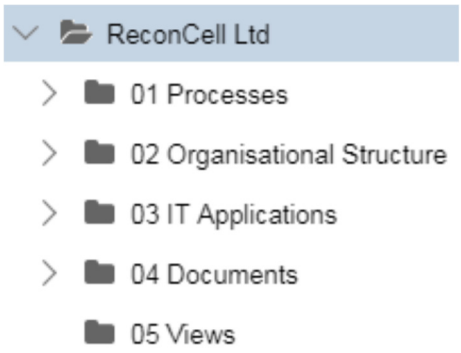


Figure 5 Main View of implementation elements within BI tool

The main BI solution for business orchestration covers the core processes, organization structure, ICT model, documents and role based user views.

The core processes (CP) for the Step 1 are:

1. CP01 New Product Development (NPD), (Koen 2004, ISO 16355)
2. CP02 Sales
3. CP03 Order to Delivery
4. CP04 Acceptance and Quality
5. SP01 Investment calculation models

During Step 1, the focus is on creating and analysing core procesesses. Using test cases for quantifying and understanding, the business team seeks to study the relationships of partners and processes. The challenge is in providing the set of commercially needed customer specific “-ilities” necessary for making a business case and credible Reconfigurable Manufacturing System deliveries. These central “-ilities” include flexibility, reconfigurability, evolvability, emerge-ability, and customer relevant RMS (Reconfigurable Manufacturing System) functionalities. Models, metrics and analytic tools that capture the RMS “designer’s intent” will allow better consideration of these properties in business and design process, as well as appropriate trade-offs that are central to good engineering and offer design. A related area of strategic planning seeks to understand how to exploit the technologic value chain in creation of ReconCell as product contrasted with the commercial value chain designed to bring it to market. Both are driven by different motivators and business models. Strategies are needed for dealing with IP issues and competitive advantage concerns in the complex ReconCell environment where many organizations are collaborating. Open technical and commercial exchange is essential to success. Test cases are used to bring forth understanding in relevant enablers and barriers.

New Product Development (NPD)

ReconCell idea of New Product Development (NPD) process follows ISO 9001 and ISO 16355 (A quality approach to new product development) guidelines (Koen 2004) (Stansfield 2017). ISO 16355-1:2015 describes the quality function deployment (QFD) process, its purpose, users, and tools. It covers the tasks from idea to production and support. Users of ISO 16355-1:2015 will include all organization functions necessary to assure customer satisfaction, including business planning, marketing, sales, research and development (R&D), engineering, information technology (IT), manufacturing, procurement, quality, production, service, packaging and logistics, support, testing, regulatory, and other phases in hardware, software, service, and system organizations.

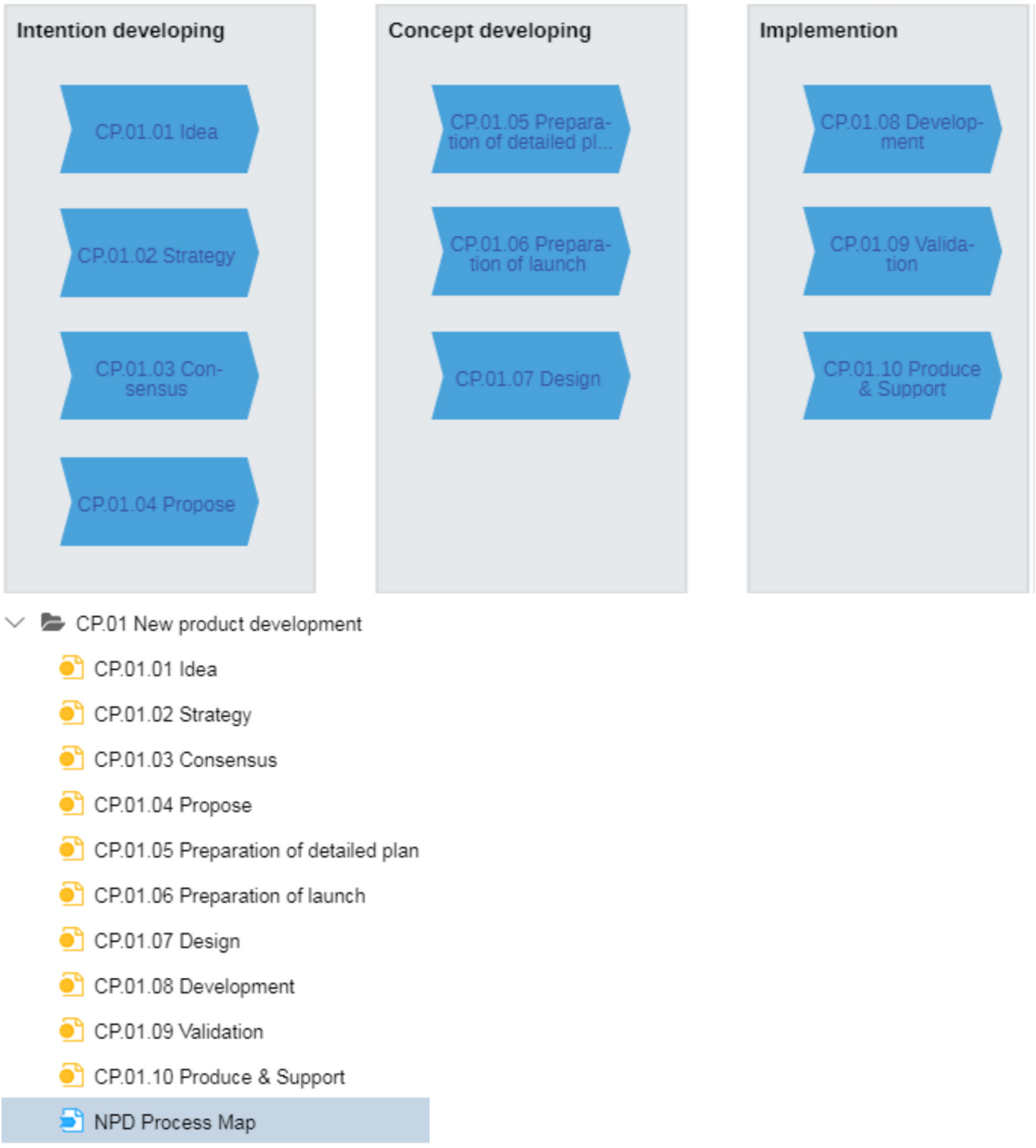
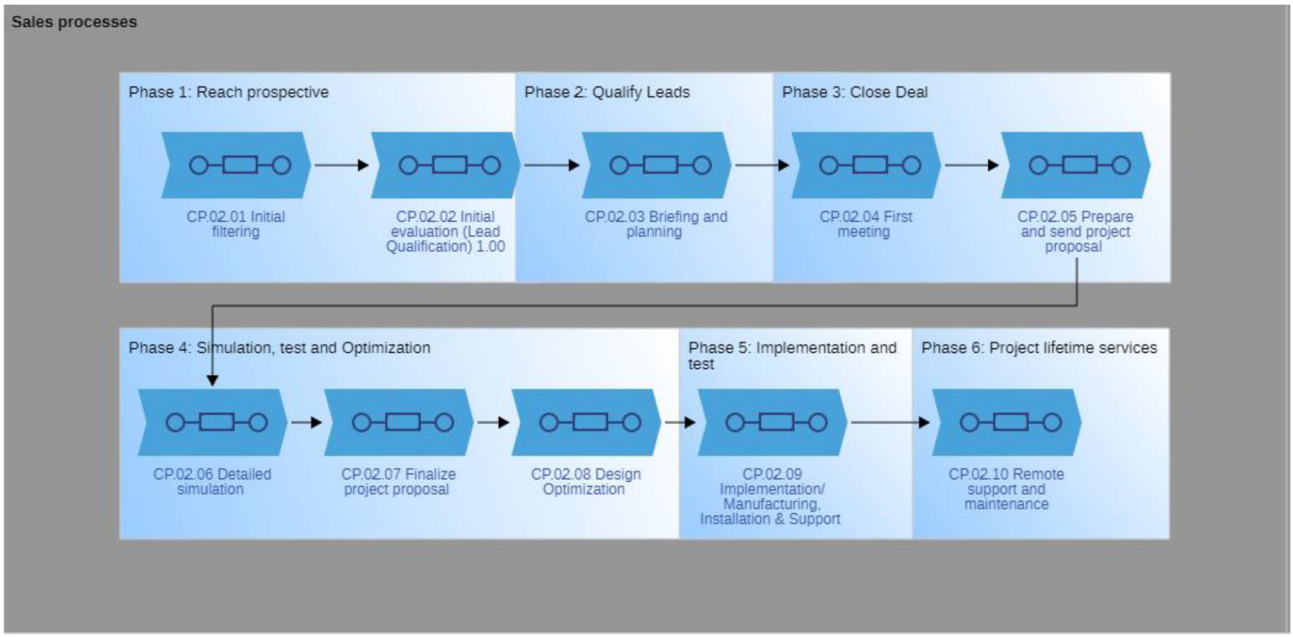


Figure 6 ReconCell NPD process map within BI

The sales process map provides the first “skeleton” of the sales process and covers roughly the needed activities from initial filtering to aftersales with support and maintenance. The sales process is built with the one-stop-shop case-partner BOR and will be discussed further and revised with all partners. The sales process is grounded on ISO 9001 Quality Management System and its primary task is to keep the customer happy. This requirement applies at all stages of the sales process e.g. enquiry and quotation, order receipt, order processing, order amendment. At each stage, the key questions are: Do we really understand what the customer wants? Are we able to meet the requirements on time and in full? Has the customer or other relevant actors changed the

requirements? A comprehensive dynamic requirement engineering (RE) process is the key for success.



- CP.02.01 Initial filtering
- CP.02.02 Evaluation and decision making
- CP.02.02 Initial evaluation (Lead Qualification)
- CP.02.03 Briefing and planning
- CP.02.04 First meeting
- CP.02.05 Prepare and send project proposal
- CP.02.06 Detailed simulation
- CP.02.07 Finalize project proposal
- CP.02.08 Design Optimization
- CP.02.09 Implementation/Manufacturing, Installation & Support
- CP.02.10 Remote support and maintenance
- Sales process map

Figure 7 Sales process map

Order-To- Delivery is a process that consists of a group of activities that receives input and adds value, which transforms the input into output for customers. As business process, it is a set of logically related activities that use organisational resources to support the objectives of the organization. The order-to-delivery cycle of ReconCell can be viewed as one big business process that stretches across partners organisations. The quality of the Business processes determines competitiveness and efficiency. The order-to-delivery cycle is first defined as a value chain and further elaborated and described as operational process involving specific organisations. The processes that form the order-to-delivery cycle are categorised in CSL framework according to their

relation to corresponding value chain activities. These generic value chain activities are further used as a framework to develop the high-level design of the order-to-delivery cycle. CSL approach directs the focus from functional departments of the partners organisation to a value chains and interdepartmental and interorganizational perspective.

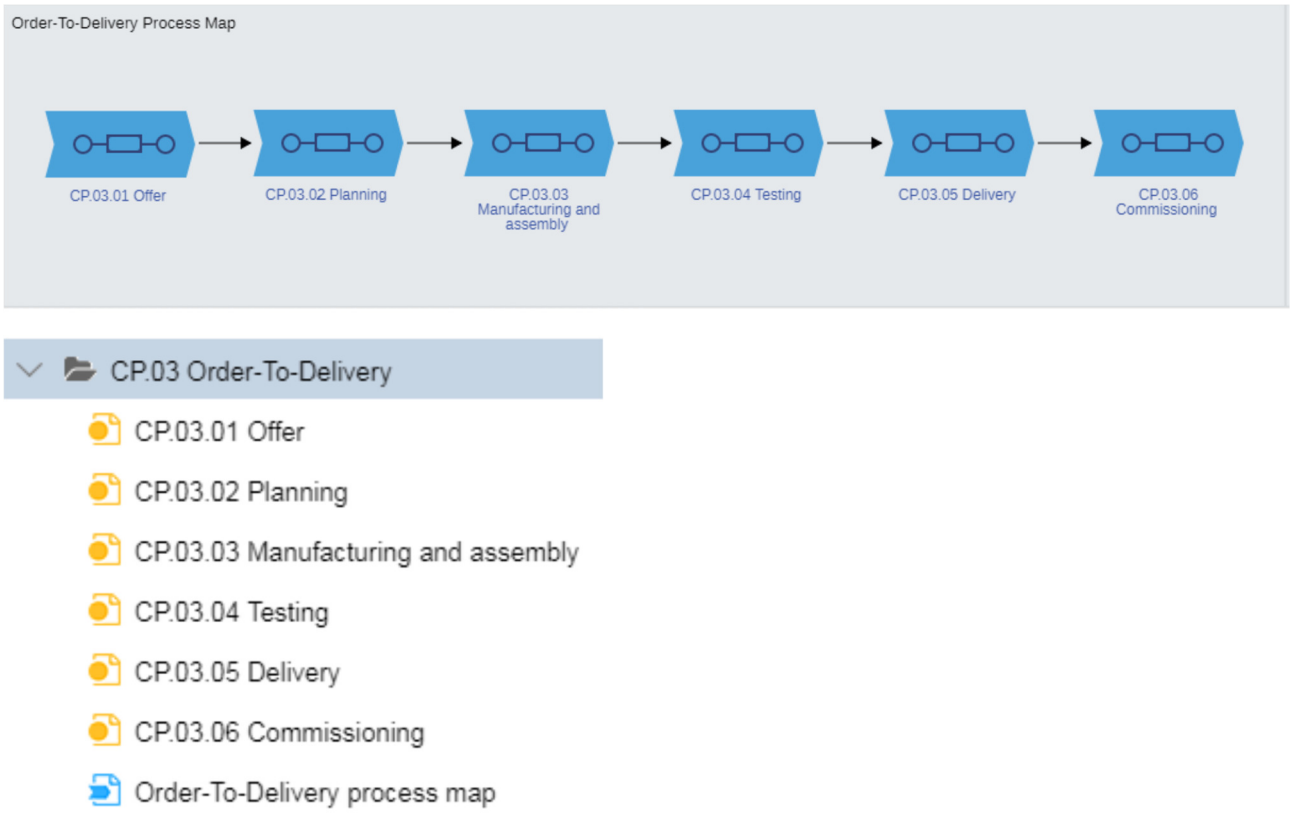


Figure 8 Order- To- Delivery process map

Order -To-Delivery process map covers the activities from offer to commissioning.

Support Procesesses

Planned support processes cover at this stage mainly different analysis sub-processes that are shared with several core processes. Investment calculations are one of those analysis functionalities that is shared with marketing, sales, order-to-delivery and product design processes. Benchmarking and VOC (Voice of the customer) and other similar analysis processes are planned but not yet implemented.

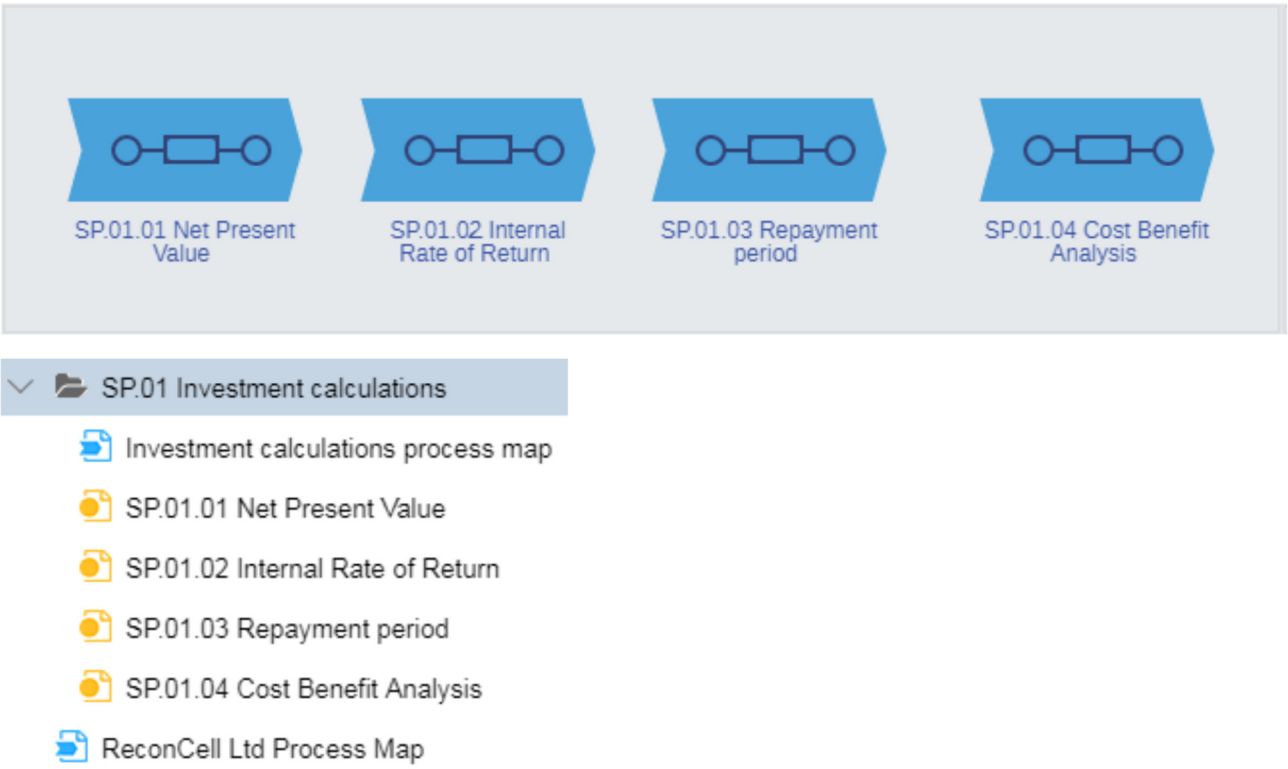


Figure 9 Support processes; Business Analysis, Investment calculations

Workshops for implementation with project platform partners:

During the period we have held several workshops to build up the business concept.

Hermia Group;	Twelve internal workshops
Business team;	Four workshops
JSI;	Two workshops. One workshop with Elvez- case

The workshops have concentrated on the intention developing methodology, requirement engineering (RE) and process design. They have been done together with JSI, HERMIA, BOR, DTU and MMI and intend to serve also as preparation for the coming open calls. Within these workshops, the partners outlined the ReconCell PSS interactions between System Design approach developed by JSI, BOR Business Assessment Tool (Inhancer), BI (Adonis) and System Design (Verosim) tools and shared process basis.

The Adonis BI and its BPM system integration implementation with Verosim and Inhancer is ongoing and similarly the definition and processes of PSS Business Model. Business Model for the interaction with customers and network, (management),

- System Model describes the System Design environment (configuration and system concept)
- Process Model describes the process design environment (organization, and delivery concept)

Each of these models describe one design aspect and their integration can be done using shared ontology and semantics. This integration work is closely tied with system design and can be done after the system design is finalized. It will take place in collaboration with Hermia and MMI using Verosim and ADOxx modelling platforms.

ReconCell business unit design

ReconCell business unit ReconCell Inc. is here seen as an emerging autonomous business network entity providing for a PSS platform supporting the ReconCell system sales, design, implementation, and constant re-configuration. It is envisioned to link the network of service and component providers, system integrators and end-users to a joint PSS platform.

BI implementation:

ADONIS BI tool is set up at Hermia and JSI and basic BI functionalities and models are shared and made available for use. BI solution will be developing till the end of the project.

1. Example processes are tested, and first case data collection started.
2. Planning of ReconCell processes using CSL approach has been started and is ongoing
3. Preparation for setting OKR and KPI framework for requirement engineering and embedding it with the processes is started.
4. Integration with Inhancer is started with BOR and is ongoing.
5. Planning of integration with Verosim using QFD will be the next step with MMI

ReconCell Product Service System (PSS) implementation

ReconCell PSS development is currently ongoing and concentrates on Step 1 basic functionalities. The development dialogue for the business scenario development and system module planning and case research is done within the ReconCell business team. This process is ongoing and the first version is planned to be ready soon.

Summary

Work Package 5 is proceeding as planned. The next tasks concentrate on improving the designed business processes, knowledge model and building the readiness for the open call. The next step (Step 2 phase) concentrates on addressing the development needs found out from Step 1 test cases. Main challenges will be to clarify all the details related to turning the envisioned value chain structures into actual processes. The companies involved in real manufacturing expect professional service and response in line with that available from the competition. At this stage ReconCell needs to mature as PSS business case.

References

- Maier, M., “Architecting Principles for Systems-of-Systems”, Proceeding of the 6th Annual INCOSE Symposium, p. 567-574, 1996.
- Lehtonen, T. (2007). Designing Modular Product Architecture in the New Product Development. Tampere University of Technology. Retrieved from: http://urn.fi/URN:NBN:fi:tty-200810021062.
- Koen, Peter A. (2004), "The Fuzzy Front End for Incremental, Platform, and Breakthrough Products", PDMA Handbook of New Product Development, 2nd Ed.: 81–91
- ISO 16355, https://www.iso.org/standard/62626.html
- K. E. Stansfield and F. Azmat, "Developing high value IoT solutions using AI enhanced ISO 16355 for QFD integrating market drivers into the design of IoT offerings," *2017 International*

Conference on Communication, Computing and Digital Systems (C-CODE), Islamabad, 2017,pp.412-416.doi: 10.1109/C-CODE.2017.7918967