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Executive Summary

This deliverable gives an overview on the planning and implementation of the ReconCell business platform as well as related approaches, methods and tools. Since the business platform is still under development, this document has been prerpared as a roadmap and discussion paper for emerging possibilities. Setting up software tools for business platform planning and business intelligence for ReconCell is done according to guidelines from deliverable **D6.1** "Technical Report on ReconCell model for business intelligence". This report aims at supporting the envisioned approach, describes the applied approaches, methods and tools as well as structure the roadmap for transition (*Figure 19*). It covers current development tools and the planned next steps for implementing an operational business platform. The document is at the same time a guide to ReconCell Business Intelligence (BI) approach and a BI platform roadmap. It aims to assist ReconCell partners to understand BI platform, BI approach, BI components, services, functionalities and tools. It presents the chosen strategy and standards, principles of selected tools, and their use.

The presented set of tools include those developed within the project and the used commercial ones. The manual discusses integration strategy and transition from current to envisioned future business platform. The tools are divided into three sets; first phase development tools, second phase platform tools and third phase advanced tools. The roadmap covers the steps and assessment of maturity of the partners and chosen business model. It is important to note that the envisioned business platform is a learning one and evolving as more information from customers and cases become available and new tools enter the market.
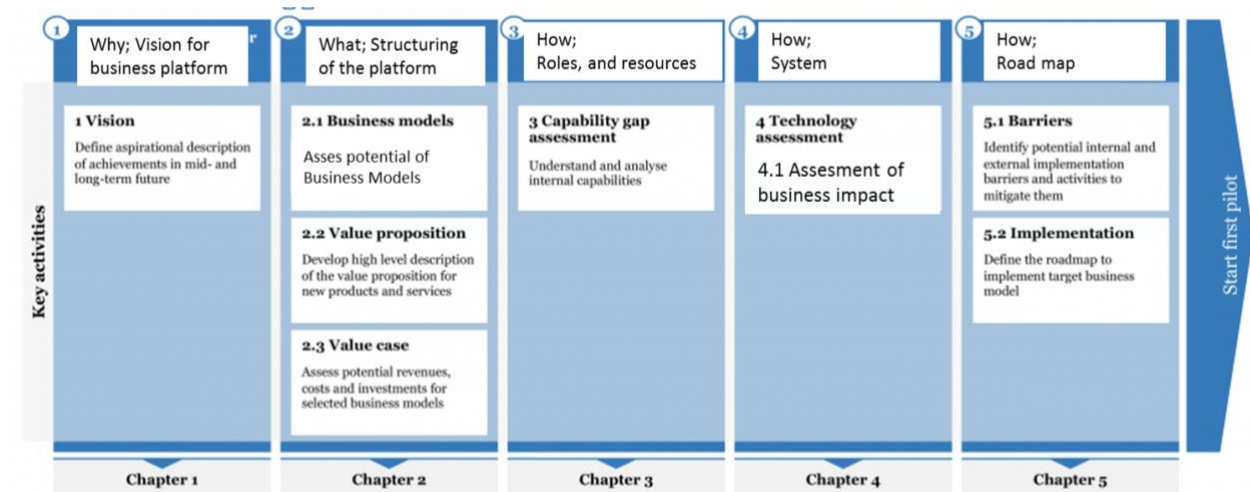

Figure 1: Outline of the vision and plan

In the initial phase of the project, the business platform idea was structured to support design and planning the platform itself and the tools selected accordingly. During this first phase, vision and strategy, business models, value chains, organization, product and services were structured. The second phase and the connected tools concentrate on the business platform and analysis tools as well as embedding the case data and the formed scenarios. Third phase tools section discusses the needs to improve the platform for an expanding business and ideas from the partners.

At current stage the platform is still in the development phase, in which use-cases are tested.

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1 Vision for Business platform

ReconCell business platform is planned to support the envisioned vision and corresponding business strategy and Product Service System (PSS) Business Model. It should be suitable for a flexible and expanding Business to Business (B2B) network of partners delivering a complex system as joint effort as a virtual company. Therefore, a collaborative software platform is needed.

ReconCell network forms currently a virtual entity consisting of companies, research institutes, universities and public/private platforms having their own environments. The aim of ReconCell is to jointly develop and deliver an automatically reconfigurable robot workcell for flexible assembly and manufacturing processes to serve business needs of customers and their end customers. In order to achieve that goal ReconCell organization needs integrative tools to serve the

Figure 2: ReconCell system

collaboration platform. The chosen approach is Product Service System (PSS) Business Model supported with a corresponding set of integrative tools.
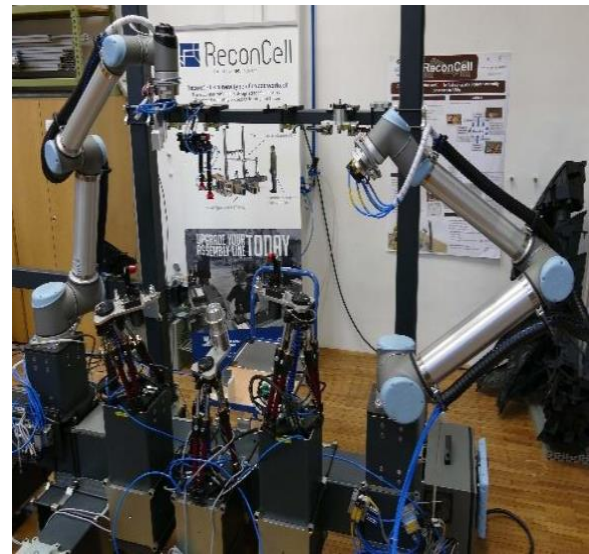
ReconCell as Product and Service Systems (PSS) is designed to be modular and reconfigurable according to anticipated customer and their customers' needs over total planned business life-cycle. The cell is envisioned to be reconfigured, refurbished and used in several many customer cases.

Due to easy integration needs the design of the supporting PSS platform is based on common standards allowing a large variety of commercial tools and business model alternatives. This concept supports flexible and fast build-up of projects and flexible integration of partner network on project basis. It allows fast cell setups, ramp-ups and reduced reconfiguring costs with needed responsiveness to changing needs in volatile business environment. The platform is aimed to provide an advanced evolving business environment both for customers and partners as well as customers to improve their product and process quality, responsiveness, flexibility and cost structure in joint effort.

Figure 3: Business Intelligence Landscape (Lehtonen et al., 2016)

The ReconCell business platform first stage has a set of assisting tools that support Product Service System planning:

Tool	Description	Tool	Contact
Visio and strategy profiler	Business system design tool based on Viable System Model (VSM)	Excel	HERMIA
Business Model Canvas	Template for calculating high-level business case for business models	Excel	COMMERCIAL

PROTEUS PSS Planner	Tool for strategic structuring of Product service Systems (PSS)	WEB	PROTEUS
PSS System Template	System Template based on E = Q / L = OKR/KPI logic	Excel	HERMIA
Company Strategic Landscaping (CSL)	Template for structuring complex PSS environment	Excel	HERMIA
INHANCER	Tool for supporting collaboration solution selling and marketing processes	WEB	BOR

Table 1: assisting tools that support Product Service System planning:

Besides the reconfigurability in the product itself, the ReconCell company aims at including a set of reconfigurable services. These are supporting:

- Internal collaboration process for core partners to react on fast opening opportunities in volatile markets of B2B assembly services
- Expanding the collaboration network with integrating new partners with suitable expertise.
- Planning, maintaining and expanding service portfolio to fit any business needs from customers from buying, leasing, system integration and capacity sub-contracting.
- Planning, maintaining and expanding strategic knowledge and resource base for different robot-based manufacturing tasks and line integration
- Analysis and support services to get most out of business processes and implementations,
- Business impact analysis (BIA) based on improvement on productivity and quality, reduction of costs and improved responsiveness by implementing reconfigurable robot-based assembly automation and line integration with possible auxiliary processes such as deburring, quality check and marking and simulation and analysis.
- Business model and process planning. Covering whole system life cycle included maintenance, service agreements, spare parts, remote support, training and joint development network.

Planning and controlling the services need an appropriate approach and planning tools.

The ReconCell robot workcell as a system platform with tools envisioned to be capable of supporting:

- Combining a suitable value offering for SME customer to optimize value-in-use by bundling. Components of product and services and taking customer in loop.
- New line design as well as re-design and retrofitting old ones.
- Service over Europe with close to customer service points.
- Standardized framework that allows rapid scaling of business and easy integration of new network partners.
- Visibility of the processes by standardized information process.
- Transparency of activities by sharing standardized processes.
- Predictive capacity and adaptability by deep integration of simulation and analysis.

To achieve this, we have planned a road-map that gradually builds up the organization, processes, value-offerings and expands the platform, functionalities and flows.

1.1 Vision and strategy structuring

Shared vison and constantly evolving strategy are the core of the platform. For evolving strategy structuring, traditional market-oriented approaches and tools like business canvas do not serve the necessary needs of the business platform development well. Therefore, we used Viable System Model (VSM) based logical frame approach and corresponding MS Excel based planning environment. The work was originally developed at Tampere University of Technology (Salminen et al., 2012) and modified for ReconCell. It is based on Viable System Model (VSM) developed by Stafford Beere[1].

The modified tool is named as PSS Profiling tool and used to support system design, strategic discussions and problem solving. It consists of seven interdependent conceptual levels.
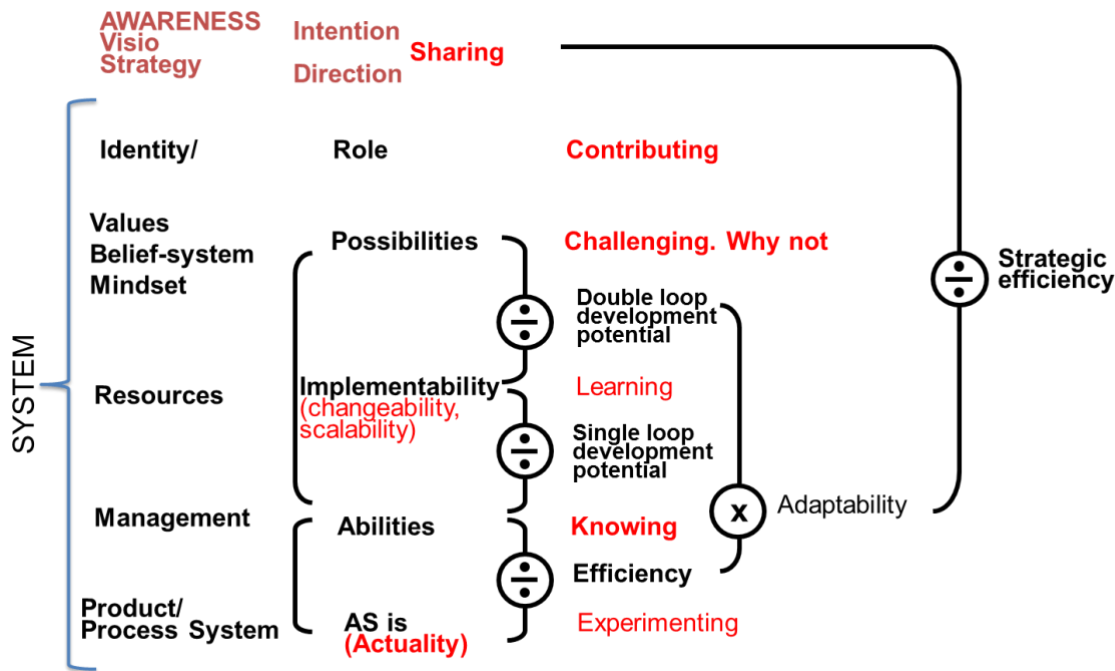

Figure 4: Levels of analysis of the ReconCell PSS Profiling tool based on Viable System Model (VSM) (Salminen & Andersson, 2008).

The tool is made on MS Excel and is intuitive and self-describing using top-down approach.

Awareness of analysis:

- Awareness level questions link the strategy to higher strategies (in this case partners strategies to ReconCell). Within B2B markets it important to align the networks systems logic with the logic of those upper systems that it is dependent.
- Visio level. Visio level aligns all the partners to aim common goals.
- Strategy level. Strategy aligns the means and principles, Business Model, value chains and value offering.
- Role level. Each network partner and system module has a role in the complex whole.
- Paradigm level, principles and ways of thinking. A PSS BM is based on shared agile paradigm.
- Resources level. Key resources are organization, processes and knowledge, technology (product and services) and network (partners and customers)

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[1] http://metaphorum.org/viable-system-model

- Management and control level. In agile PSS paradigm control is embedded into processes and teams with maximum amount of self-management.
- Operative level. Operative processes are standardized and made visible, transparent and predictable.

The profiling tool is adapted to ReconCell's needs by Hermia and made flexible to allow easy evaluation and assists in finding the problems at early stage. It can also be used with customer cases. Balancing the layered system by moving up and down improves the solution and helps directing resources. The tool is originally meant to be used as part of Lean system planning according to GD3 process (Good Discussion, Good Design, Good Decomposition) process for strategic alignment of the design rules. GD3 has been developed by Toyota.[2]
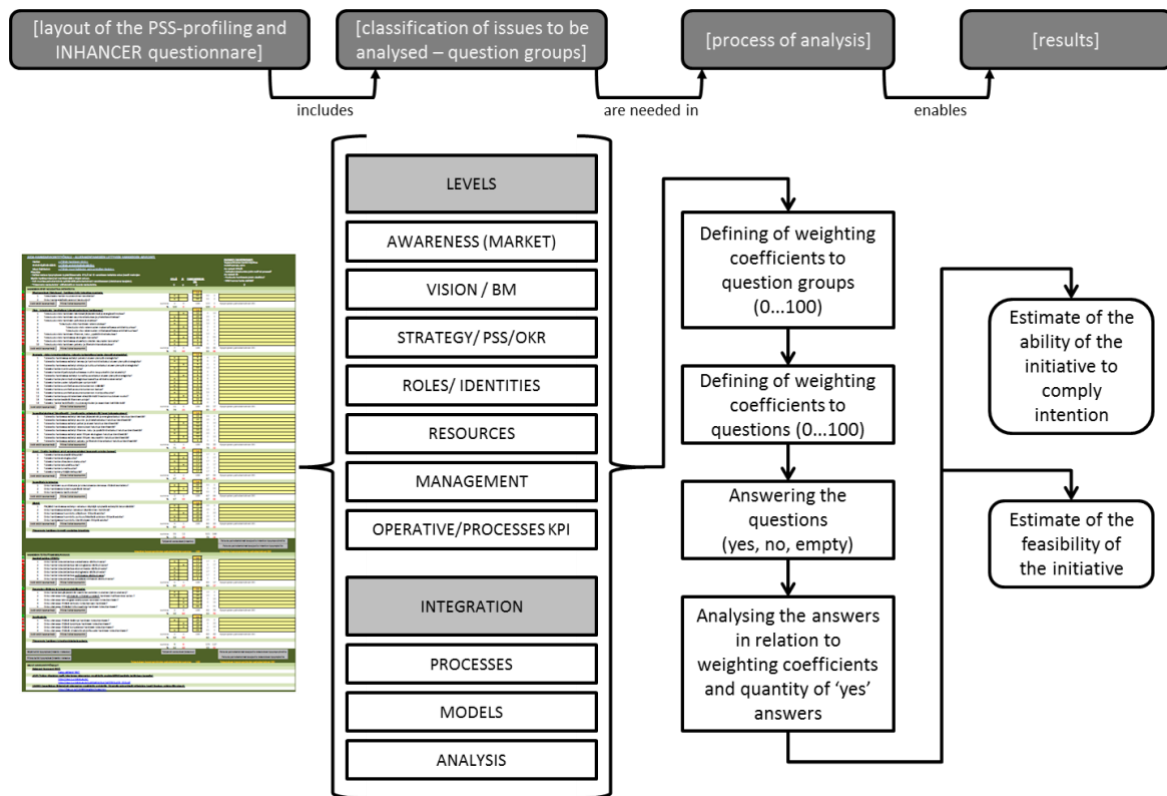

Figure 5: Business Model PSS Profiling tool structure (Salminen et al., 2012)

Excel based PSS Profiling tool is easy to set up and self-explaining. It helps to form a quick idea of various Business Model alternatives, their weaknesses and helps to assess the maturity of the current systems. The tool is adapted and provided by Hermia Group and its set-up and use is trained during case workshops and offered as service for partners. It has also Balance Score Carding (BSC) system table to assist business requirements alignment work.

The PSS Profiler was used first for the development of ReconCell Business Model BM. As in some BM alternatives the customers, and in some cases customers (Case LDT) were also joining the network, it was used also for aligning customer needs and requirements.

Evaluation of customer cases from point of view of feasibility from various levels of analysis (Strategy, roles, control, process etc.) raises several interlinked questions related to performance evaluation. Feasibility evaluation is grounded on complex social, technological, economical, ecological, political and legislative aspects and mostly covered in system design. Whereas the performance is relational (E = Q/L) and has to be

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[2] https://elsmar.com/elsmarqualityforum/attachments/gd3-activity-english-pdf.4095/

done constantly. Sufficiency of the resources and possibilities are estimated case based whereas conformity to law, availability of processes to cover the entire life cycle, technological premises and sufficiency of the network and information to realize the initiative are pre-planned. Performance evaluation and development is both internal and case-based. It is a task requiring evolving knowledge, capability, competence and collaboration. The network partners have several tools ranging from cost benefit analysis and selected set of Key Performance Indicators (KPI) for profitability, productivity, cash flow, capital use and other objectives. These are balanced using the PSS Profiler.

The Profiling tool uses additional Balance Score Card (BSC) view to integrate with customers using BSC system. The Balanced Scorecard is a common framework of larger companies to implement and manage their strategy. It links a vision to strategic objectives, measures, targets, and initiatives and balances financial measures with performance measures and objectives related to all other parts of their organization. BSC was originally published by Dr Robert Kaplan and Dr David Norton as a paper in 1992 (Kaplan, Norton 1992).

Initial Product structuring of ReconCell is not yet planned and designed according to selected PSS Business Model requirements. The first prototypes are designed from re-configurability stand point and using components based on the functionalities needed for test cases. However, when strategy, business model, organization structure and value chain tactics are better defined, also the product and services need to be re-structured accordingly. For that purpose, a suitable approach and tool is needed. We discuss on the possible approaches and tool closer within the roadmap.

The business case of ReconCell originates from the awareness of low use of robotics in assembly especially in SMEs due to high investment costs, long ramp-up times and lack of internal expertise. Therefore, these are the first issues to be solved since there is acute needs of the European assembly-based industry to improve response time and reduce investment costs. From a business system point of view the PSS concept of ReconCell addresses the requirements by combining efficiency impact of agile team based collaborative models, capital usage efficiency of virtual enterprise, expanding of business by service economy and combining economy of scope by project-based models with economy of scale and design and knowledge re-use by re-configurability. Therefore, the tools need to support;

1. Agile collaborative teams
2. Virtual enterprise systems
3. Service economy processes
4. Project and role-based organization
5. Model based planning to support re-configuration and design and knowledge re-use
6. Scenario based planning

The key novelty of the ReconCell business platform idea is to collect several SMEs with different roles, their service providers and research units under the same system platform with partially shared resources and solutions for project-based collaboration. This approach enables the partners to focus on their core competences and systems and achieve at same time a new level of business presence by collaborative networking by integrating efforts by shared business processes.

The strategic business aim is to address the true competitiveness measured as business continuity and survival of all partners in the network, including customers. The key requirements are, profitability, positive cash flow, and balanced capital management;

1. Adequate revenues, increasing sales and sustainable price level; marketing and sales team
2. Efficient product and service process; improving productivity and sourcing; process team
3. Efficient resource and capital management; administration team

Main Characteristics of envisioned ReconCell business vision can be described with the following terms; Co-evolution, co-creation, resource sharing, agile and competitive public-private synergy system.

In ReconCell business platform vision the system and organization interaction is facilitated by core partner system where the core platform is maintained and developed by core partners. Core business platform consist of basic shared tool and has a support system layer to provide support services. These services are similar to those ReconCell needs to provide its customers. As the core platform extends to several core organisations one must have a joint process team to structure, maintain and develop strategy, organization, value chains and value offerings.

The business platform must be able to configure to serve multiple customers dynamic needs and thus to orchestrate complex service network in real time. Therefore, it has to adapt the values and attach to vision and strategies of partners and customers it is serving.

The key difference with traditional organisations is that ReconCell agile project and role-based team system organizes for desired behavior and measures itself constantly. Whereas traditional companies are made for purpose to produce, be profitable and are measured according to profit and output as single business units on the long run. Measuring behavior supports evolving project organization and team-structure. The quality of product and services on the other hand is based on standardized work and processes. Agile project-based system uses integrated configuration support layer to solve the problems and ensure correct behavior and ensure that system can co-evolve sharing bottom-up and top-down factual and tacit knowledge and transition experience fast and effective way.

2   Structuring of Business platform for Business Models

Business platform has both internal structure for internal processes and external structure for customer processes that support the chosen Business Model. Internal processes cover the processes and tools used for the internal business processes and external processes cover the tools for customer processes.

The ReconCell Business Platform is planned to support the basic business processes of the envisioned Product Service System Business Model. Processes are structured to align with corresponding strategy, organisation, product, services and value chain goals. Product and service structuring is made using PSS profiler developed within HERMIA and adapted to ReconCell assisted by PROTEUS PSS Configurator. PROTEUS PSS tools are web based.[3]

Both PSS planning tools are used together with Company Specific Landscaping (CSL) tool. The strategy process is structured within workshops. These tools can also be used for designing products and services for customer processes. As both, the product and services of ReconCell, are intended to be standardized, pre-defined the customer specific work is adaptation with configuring and re-configuring tools. This approach can be seen as "Brownfield" process, since the adapted system is not customer specific (Pakkanen et al., 2016).

The aimed process is also scenario based as it is planned for providing a configurable solution for different application scenarios for anticipated needs of selected customer group and based on the previous projects and experiences. The main aspects in enabling benefits with design reuse in business environments in which product variety is needed are;

- Focus on designing products and services reusable and re-configurable
- Developing operations and support systems platform to facilitate using of reusable elements in product delivery projects.
- Support systems for design reuse in order to align project and role-based business platform is based on core processes.

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[3] http://www.proteus.dtu.dk/results/tools/pss_configurator(1)

- Business Intelligence (BI) platform that allows modelling of the business processes to integrate operations, made them visible, transparent and predictable.

During design phase the integration is done using *INHANCER* tool that contains market and sales model. The product model is maintained in Verosim environment and the projects model managed using JIRA- platform. Basic idea is to use development step to create case scenarios and pre-made models (PSS BM) as base of the planning the business platform.

The strategy is to structure Agile processes that are based on efficient teamwork of experts and facilitate close collaboration with customers. The platform aims to be a flexible and simple access to vast resource pool and shared models and provide the needed collaboration. Therefore, the tools are planned to embed value offerings within connected, visible, transparent, predictable and adaptable processes.
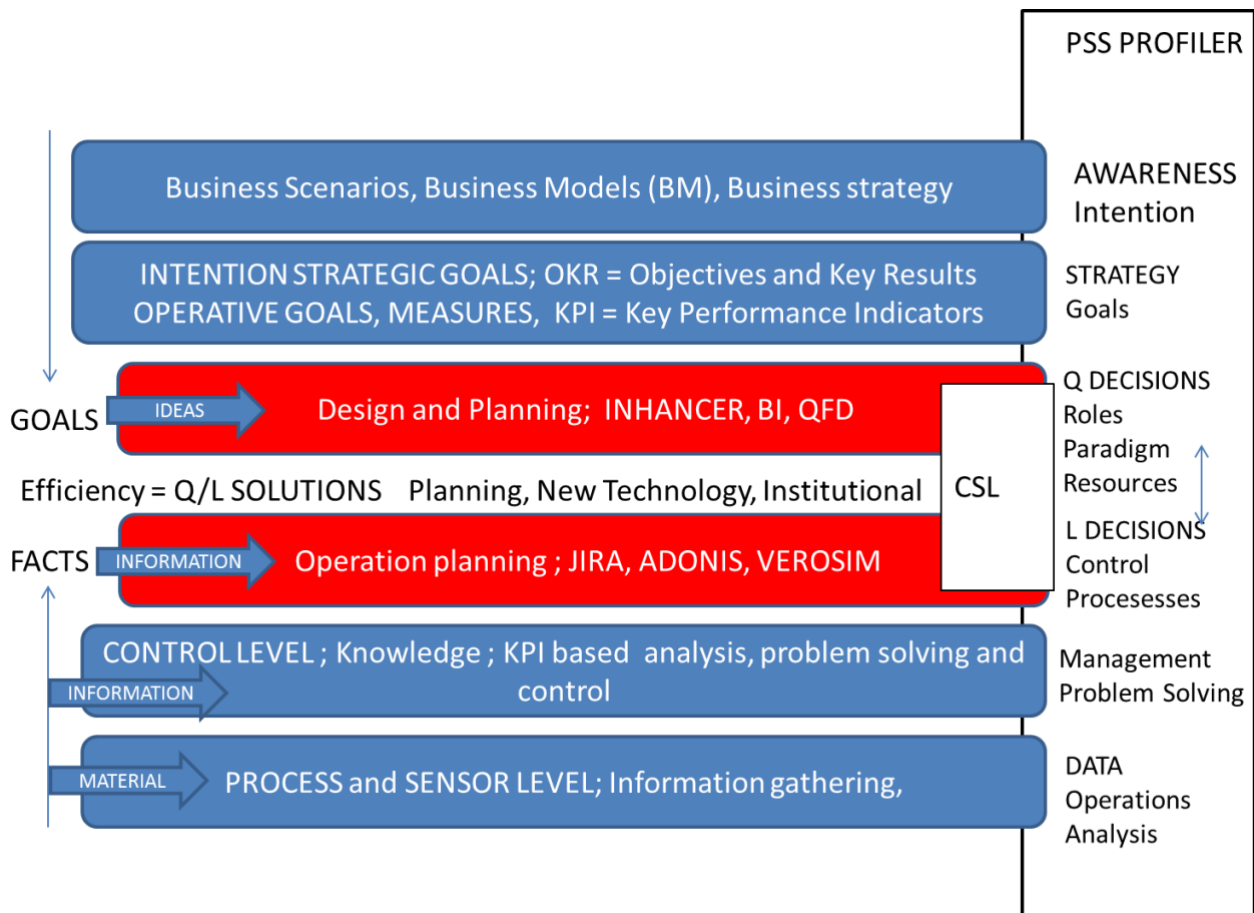

Figure 6: Business platform and tools in VSM logical framework template

The software platform integration and planning template uses Viable System Model (VSM) structure and integrates the Visio to operations.

- Visio level: Business scenario Business Model and Business strategy planning tools.
- Strategic Goals: OKR (Objective and Key Results) and KPI (Key Performance Indicators) setting.
- Business platform that supports key functionalities and processes. Model based planning and control.
- Control system, orchestration and problem solving according to OKR.
- Process performance measurements according to KPI.

The ReconCell business is a dynamic process as the business and partner network evolves. This manual gives the roadmap and describes the initial phase approaches, methods and tools.

ReconCell Business platform and corresponding Business Intelligence (BI) platform are designed and planned in 5 maturity steps:

1. Initial: Business processes are not yet standardized on platform level. Requirement Engineering takes place and effort concentrate on joint research, planning and design of product and services. Used tool for business design is PSS Profiler (Appendix 1)
2. Managed: Strategy, roles and Business Model are selected and defined, and key processes are planned. Partners manage their sub-processes independently. Used tool is Company Specific landscaping) and PSS Planner.
3. Standardized: ReconCell-wide strategy, roles and business models as well as business processes are implemented. This phase is still ongoing. Used tool is INHANCER and Business Process Modelling (Appendix 2)
4. Predictable: A quantitative and qualitative planning and monitoring of the processes takes place to achieve predictable results. This phase is planned to be implemented along with second step process-based business platform.
5. Innovating: The processes are continuously developed and improved. Used approach is Business Impact Analysis (BIA)

For planning, design, implementation and maintenance of BI platform a strategic business team is needed. PRODUCT SERVICE SYSTEMS (PSS) is an innovation strategy, where a greater integration of products and services has the potential to decouple business success and economic growth from mere product sales. Instead of viewing ReconCell as an isolated entity, the PSS design activity focuses on creating the right combination of configuration and providing life-cycle services, needed to aid the customer in reaching their goal.
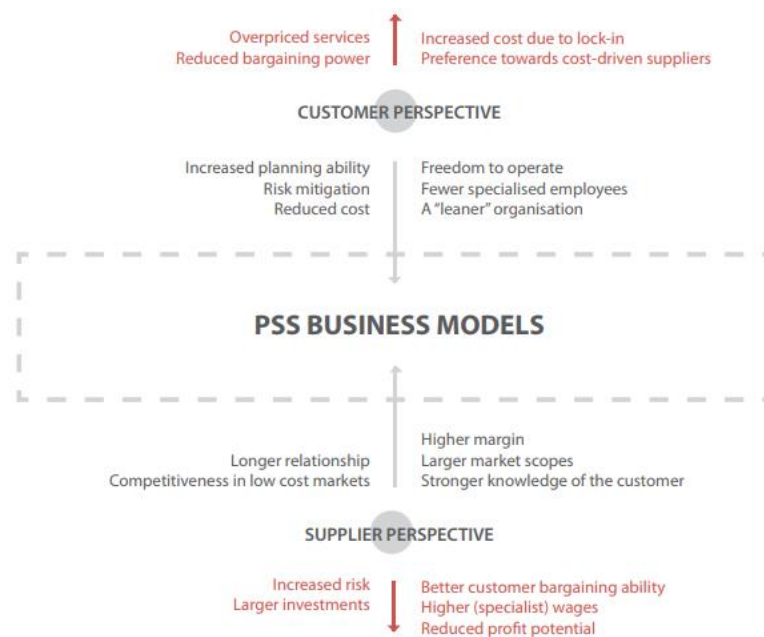

Figure 7: Business Impact of PSS (Finken et al., 2013)

Incorporating service thinking into the product development process (NPD) gives rise to new business opportunities; the product has the opportunity of being made re-configurable and more robust throughout its life cycle (i.e. it is 'Designed for Service') and the customers' entire needs and activities are considered and catered for, from the very beginning of the development process. A PSS solution does not necessarily imply that the service provider is the producer of the physical product(s) included in the PSS, but the service provider must take responsibility for the delivery of the service to the customer, including its timing, physical elements, agreements and related risks and be capable of integrating with customer for long term.

By investigating the activities and realising the actual needs of the customers, using *INHANCER* we reduced the complexity by segmenting potential customers and collecting customer requirements and project specifications from early communication with them. In a PSS directed to B2B markets and subcontracting SMEs, both the customer's and customers life cycle needs are the main drivers, which poses a risk that the offerings needed to support the customer will require intricate and unmanageable business models. For this reason, any PSS should be a balance between addressing as many crucial needs as possible (creating an impact) and ensuring that internal costs for supporting the offerings minimize. As an example, the need to support the customer globally will often lead to escalating costs. One way of ensuring that the PSS solution developed has the biggest impact with the customer, while at the same time not being overly complicated, is to describe the customer's activities and context in a meaningful way and then map costs and ability to support onto this representation. Activity-based management and costing will help.
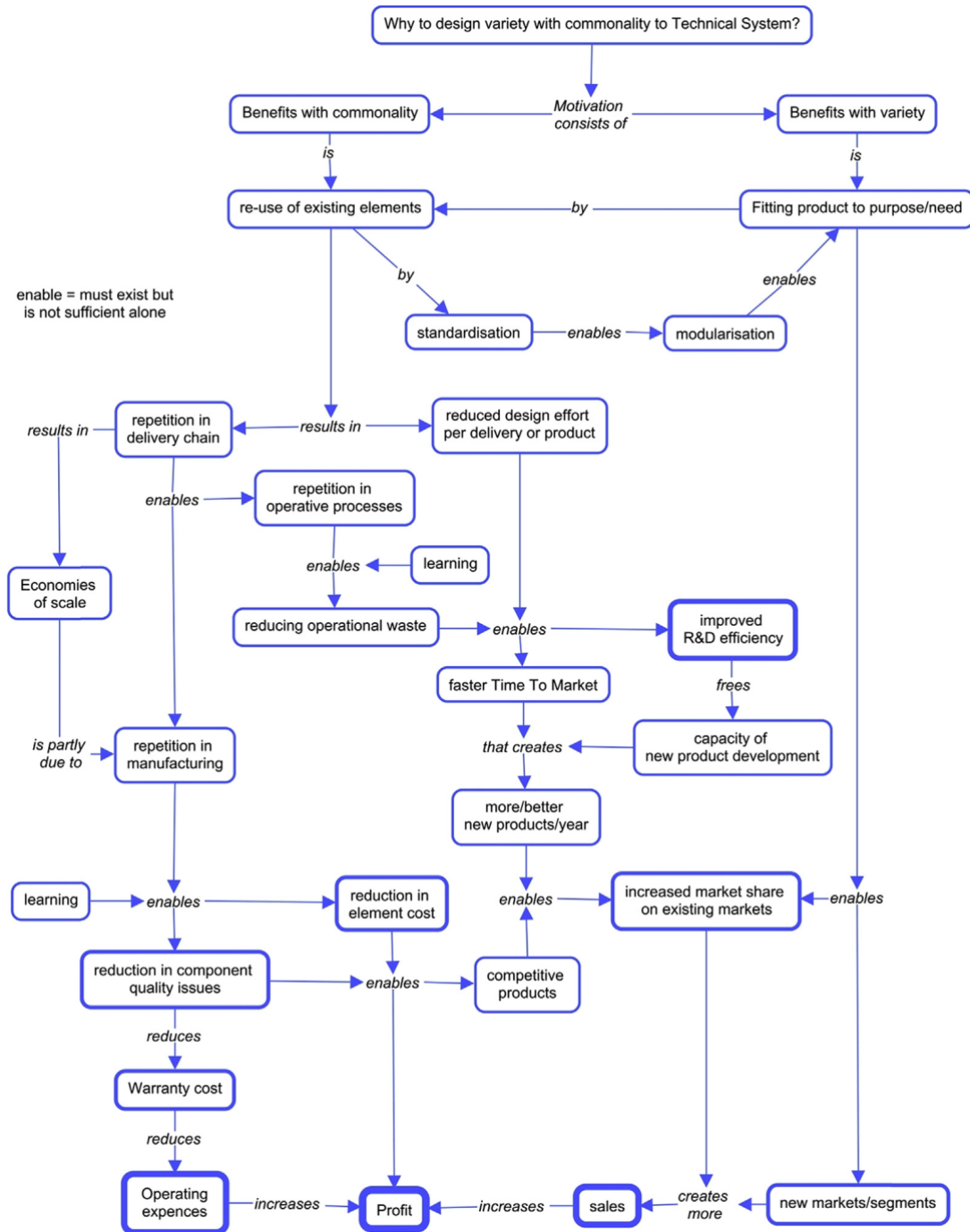

Figure 8: Business impact analysis for a re-configurable system (Pakkanen et al., 2016)

2.1 Company Specific Landscaping tool for structuring of Business Platform

Company Specific Landscaping (CSL) template is used for structuring Business platform strategy, Business Model (BM), organisation and value chains. The idea is to achieve a stabile core platform that can meet the customer needs with minimum re-configuration work. The basic need is to align different models and the processes. It is done by combining partners core competences, business models and value chains to form a networked unified PSS (Product Service System) platform. Strategy process provides base scenarios that guides value chain and organizational structuring and finally process and service structuring.
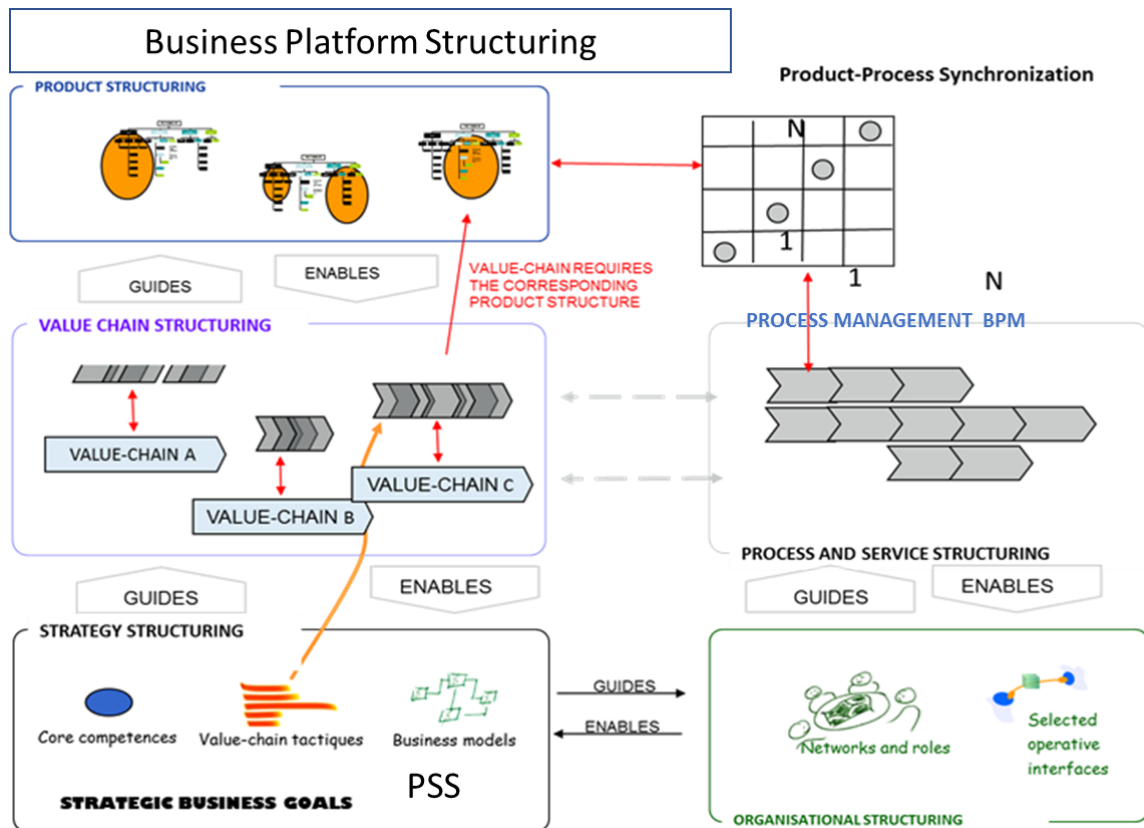

Figure 9: Business Platform Structuring template (Pakkanen et al., 2016)

2.2 Value chain tactics and organisation structuring

We used CSL together with PSS Profiler and Proteus PSS Configurator to evaluate the needs for basic structure capable in meeting the business strategy requirements. Product, Services and Value chain and organizational structuring should be done simultaneously as they form a complex system.

Value chain structuring is done first for main value chains that meet the customer requirements (so called Q processes). Secondary value chains are partners' internal processes and those outsourced. They are referred as dispositional processes (q – processes). The used planning tool is any Business Process Planning tool that uses standard modelling language (BPML 2.0). We used ADONIS[4] for process planning, ADOIT for information flow structuring and ADOSCORE for business process analysis. Logic Data uses compatible tools like SYGNAVIO. The work will be finalized once the ReconCell company is operational.

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[4] https://us.boc-group.com/adonis

Strategy, value chains and organization (as of now the ReconCell as virtual organization in the CSL structuring tool, which refers to the first phase before ReconCell Ltd) need to be structured together with products and services. The initial idea until a company is established was to approach ReconCell as virtual organization with a project-based collaboration platform without any specific core-company. This model allowed for a case and project-based approach with team-based matrix as suitable structure without the need for a formal company as all the partners are sharing the responsibilities and there are no external users. The current partners can allocate projects and team resources that are at the same time employed by their own organization and source the resources using own budgets. By using a simple Activity Based Management and Costing (ABMC) template with standardized processes described in BPM-tool, it is possible to allocate and estimate the costs, time and quality of the services on case- project basis.
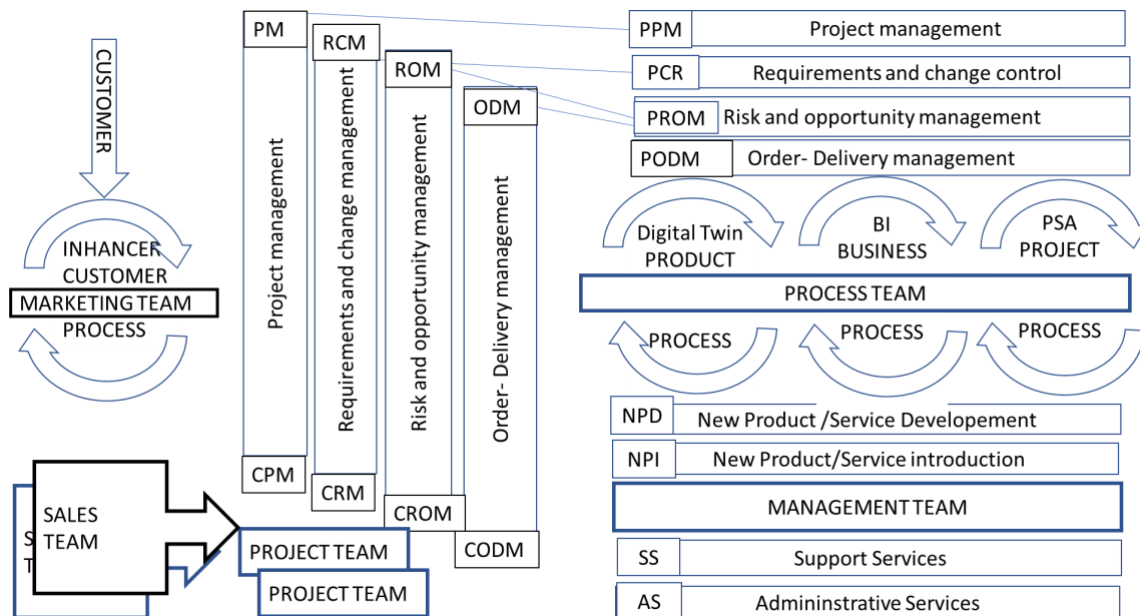

Figure 10: Business Platform idea; teams and processes

Idea of agile team- and project-based structure should cover:

- Marketing team and processes for global presence.

- Sales teams and processes are covering local needs.

- Project teams. Project teams that have expertise of the product and services and ability to implement the system.

- Process team is needed to R&D and design of the services and processes and for maintaining of the models, support tools and systems.

- Management team is needed for the administration, HRM (Human Resource Management) and financial planning and resource allocation tasks.

One person may have several roles in several teams and scheduling. HRM can be done on task-based allocations. Each partner can use their corresponding project software-platforms if they are compatible.

At initial stage the projects are managed supported by project management platform. We selected to use JIRA[5] and compatible tools. However, when the maturity of the business improves and scales up, there is a

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[5] https://www.atlassian.com/software/jira

need to apply a suitable Professional Services Automation (PSA), Business Intelligence (BI) or ERP (Enterprise Resource Planning) tool. For the next stage for instance Forecast PSA tool[6] could provide suitable meta models.

In order to cope with the needs to understand the markets and develop the product and services we introduced the INHANCER, a web tool based on circular automation business assessment process model (Parizi, 2018). INHANCER is developed by Blue Ocean Robotics and aimed at providing ReconCell a Business Assessment and Solution Selling Processes assistant in early stages of automation decisions. It is planned, designed and implemented as an integrated service for system. It supports a company internally on sales and marketing, system design and delivery as well as externally by supporting the user with acquisition, adaptation, use and re-configurations.
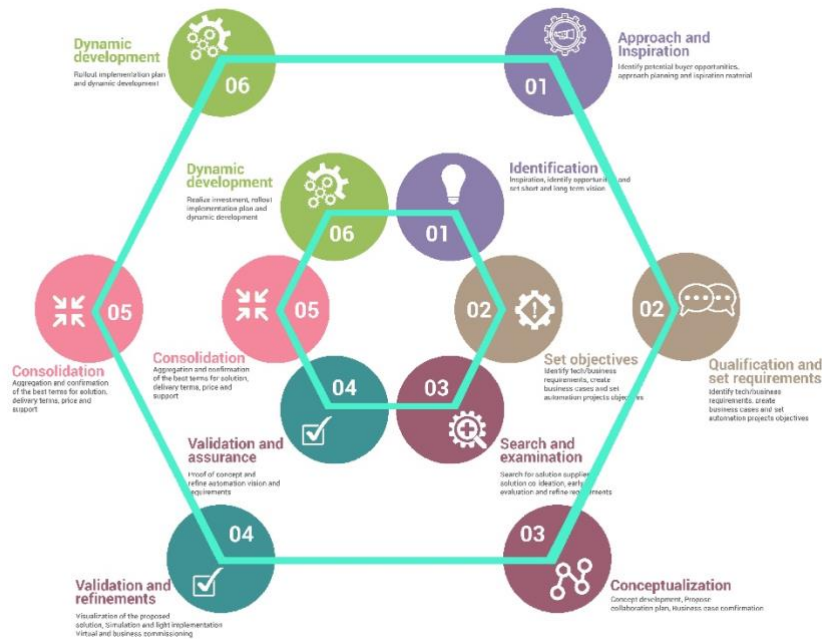

Figure 11: Circular automation business assessment process model (Parizi, 2018)

INHANCER is made as a facilitating tool for defining and orchestrating the business project by connecting end-users' decisions, information and knowledge timely and accurately with ReconCell process. It is aimed at facilitating customer collaboration with sales and collecting all vital data about how an envisioned solution
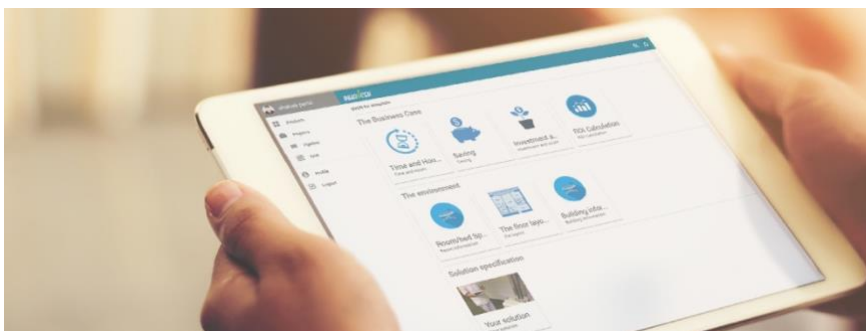

Figure 12: INHANCER project interface

by future end-user (manufacturing companies) can be supported to meet their goals by configuring and integrating the solution. It assesses which configuration of product and services are needed in order to integrate solutions into production lines and business process.

Besides support the sales team, INHANCER integrates with the process team that need to understand the evolving end-users' needs and embed them into configurations throughout the project life-cycle and translate needs into configuration-suggestions and system requirements.

ReconCell conducted marketing research and found out that the customers and their automation investment decision process and buying behavior is changing. Manufacturing has networked and globalized and balancing over several tiers and needs for fast response with constant re-configuration needs increase the challenge in automation investments. Companies have easy access to vast amounts of information on available services and systems. Moreover, value offerings and business models are changing offering customers a lot of choices. Contacted manufacturing companies drive the investment decisions and want to contribute on solution development process aiming at increased competitiveness. Collaborative selling is considered as a state-of-the-art selling methodology. The mindset is that the solution provider is expected to act as a trusted advisor, assists the buyer in identifying needs and offering long term collaboration with a large variation of options.

Figure 13: INHANCER Story Board

As a potential project moves through different phases, the probability of success sales increases because the unknown and uncertainties of the project are driven down with each stage and step. Both, the automation provider, and the potential customer gain more understanding of the project and its requirements while the sales process proceeds. Without a systemic sales support platform this is a costly and messy action for both partners as they need to spend a lot of time on communicating and understanding the projects, even if the probability for a potential sale is depending on speed and accuracy. In addition, this takes up time from both parties from their core business.

This dilemma shows the need for a system that manages the risks and removes those projects with a lower degree of probability through the sales acquisition process in an early stage. Furthermore, key component and system suppliers face communication issue within sales and configuration processes. The problem lies in long waiting times, never-ending e-mail listings, many possible sales getting unattended and an overall lack of structure.
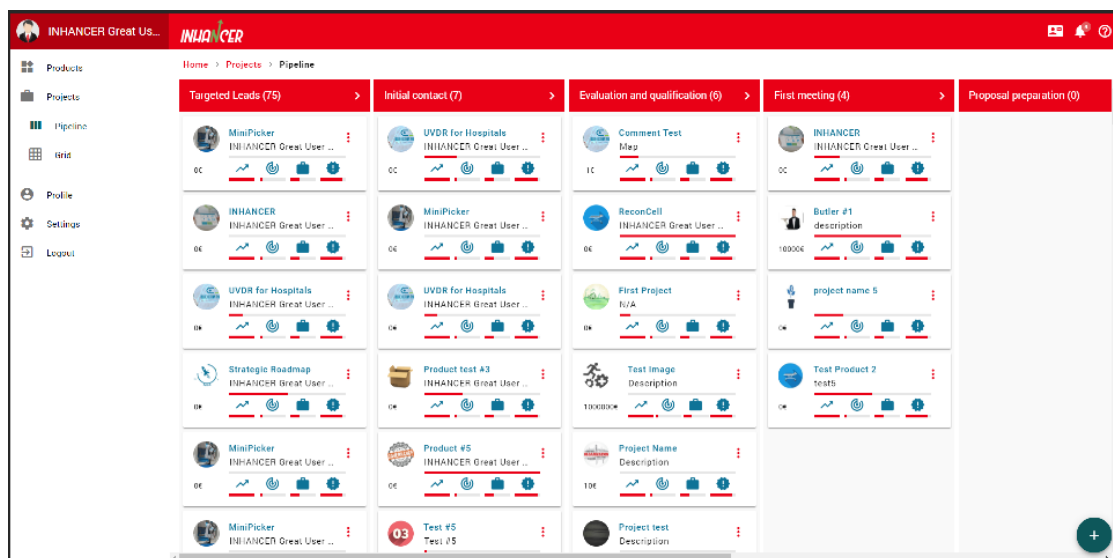

Figure 14: An overview of the projects in pipeline and the way they move between phases in INHANCER

INHANCER provides a sales model that integrates with business model, product and services model and is an integral part of dynamic design, implementation and control process[7]. The basic functionalities support the sales team to:

- Collect feedback from potential customers or investors about a robotic solution (technical as well as business aspects) and their products/ production lines;
- Facilitate a potential robotic solution project documentation and analyses;
- Optimize the touch time and the data flow in the sales channel;
- Facilitate a potential robotic solution project evaluation to prioritize projects with a higher degree of probability and remove orders with low degree of probability in the early stages of sales process;
- Facilitate and automate some processes of preparing sales quotes and sales documents
- Provide significant sales capacity and larger pipeline by improving the ability of working on several projects at once and in a larger geographical scope;
- Dilute corporate management involvement in project details;
- Learn to work in a more complex organizational structure and working with sales partners;
- See a project in real life carried on to completion.

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[7] For detailed user manual see: http://docs.reconcell.eu/

INHANCER maps innovation processes for different business models and use cases through a collaborative buying/selling process. This creates an integration between different buying/selling behaviours through different stages of the process.

An efficient meta model based BI tool platform is needed only when the business expands further. A suitable BI platform candidate for expanding business could be for instance ADONIS[8] integrated with other ADO-family tools that we tested for basic cases. These kinds of tools allow agile structuring of the complex business process environment and the possibility to build meta-model-based link with sales and marketing teams and project and process teams integrating sales and product design and process control. During initial stage we used static integrative approach with simple Quality Function Deployment (QFD) tools, but a process-based approach is needed for the next step.
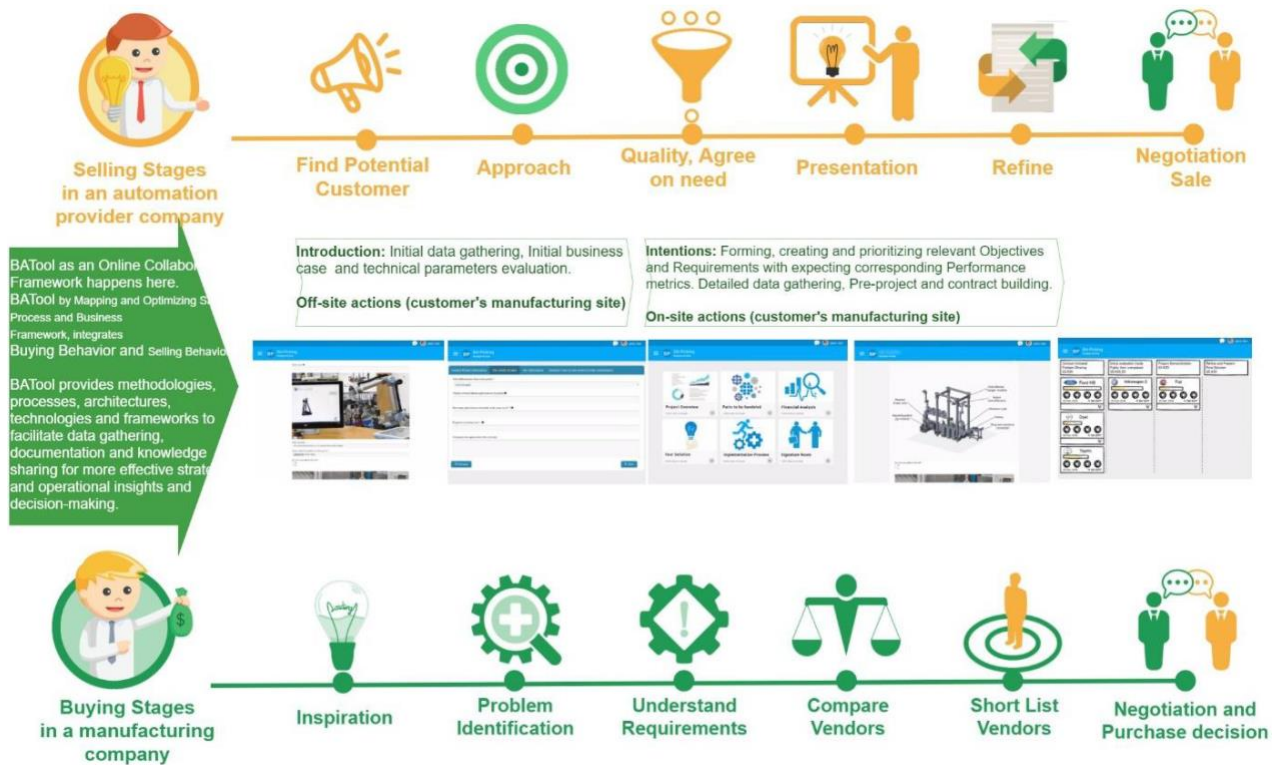

Figure 15: Business Integration between Automation Customer Behaviour and Automation Provider Behaviour

Typical customers of ReconCell are themselves subcontractors within Business to Business (B2B) type service business. They are committed to their customers' strategies and need to adapt fast and efficiently. For them producing "results" is the main target, rather than solely buying products like ReconCell assembly system as specific artefacts. Their customers, that are usually also manufacturing firms, use the results on their business. This makes the planning for use cases diverse and business environment for envisioned PSS volatile. Responsiveness based on agile processes and exact the needed services is a key demand. This can be achieved by seamless processes, quick adaptation and minimized customization. ReconCell network needs "core-processes" for project organization that allow autonomous engage with customers and meet the life-cycle planning needs of the systems to be delivered, and one central unit that takes care of the business platform.

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[8] https://us.boc-group.com/adonis

Second phase ReconCell Business Model (BM) PSS platform aims at expanding the rationale of how ReconCell as organization creates, delivers, and captures value. It will be constructed to allow the business cases beyond simple system delivery towards service intensive model. Carefully designed modular product concept and related life cycle services comprising of tangibles (the products) and intangibles (the services) are envisioned to allow more flexible customer specific delivery variations.

Basic teams and processes to form a dynamic agile business platform:

- Management and Process Teams

    1. New Product/Service Development (NPD)

    2. New Product/Service Introduction (NPI)

    3. Support Services (SS)

    4. Administration Services (AS)

- Process and Project Teams

    1. Project management (PM)

    2. Requirements and change control (RCC)

    3. Risk and opportunity management (ROM)

    4. Order -Delivery management (OD)

All commercial BI tools like for instance ADONIS[9] (used by Hermia) and SYGNAVIO[10] (used by LDT) have the necessary functionalities to build up this platform and embed standardised business processes using standardised BPML 2.0 allowing for smooth integration.

First phase Core Teams, processes and tools:

- Marketing and sales team; INHANCER module
- Project Teams
    a. Project management; JIRA (compatible PSA tools)
    b. Requirement and change control; QFD based tools
    c. Assessment, Risk and opportunity management; EXCEL based tools
    d. Order -Delivery management; INHANCER (PSA or BOM based ERP tools)
    e. Product and services mapping, ISO 9001, QFD (Excel, spreadsheet, PSA or ERP based tools)
- Process Team
    a. Product Design Process; Verosim environment for product design and development
    b. Value Chain structuring; BPML based editor tools for business design and development (Adonis)
    c. Product and service structuring; INHANCER
    d. Case profiling, (PSS Profiler)

ReconCell business platform implementation and development is done by the following steps guided by business team:

- Step 1 (strategy process): strategy structuring, business model development based on core competences and value chain tactics.

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[9] https://us.boc-group.com/adonis/,

[10] https://www.signavio.com/

- Step 2 (organisational structuring): Partner role selection and building teams

- Step 3 (value chain structuring): PSS, Lean and Agile Paradigm and BPM methodology

- Step 4 (product and service structuring, ISO 9001 HoQ, QFD): Modularization, technology, human, capital and knowledge

- Step 5 (management processes, product and process synchronisation): management system building and OKR and KPI setting supported by BI assessment tool

- Step 6 (process and service structuring, Value Chain Mapping): operative process and implementation.

These tools allow the test of the platform and form the phase of planning the next phase platform.

2.3 Requirements Engineering (RE)

ReconCell business platform and BI solution addresses total life-cycle view of the product and services both from customer and customers' customer view and serves also the development of PSS itself. Needed Requirements Engineering (RE) process needs to evolve from its traditional role as a mere front-end to the systems life cycle towards a central focus of change management. Dynamic Decision Management (instead of business rules) and capability modeling, including Case Management are key functionalities for agile business processes. ReconCell needs a systematic process to proceed from informal, fuzzy individual statements of requirements to a formal specification process that is understood and agreed by all stakeholders and supports an evolving and re-configuring system during the project life-cycle. Needed RE 'establishing visions in process context' is a central part of agile management activity. To meet fast changing needs of customers in product and service requirements, special emphasis is placed on aligning physical product characteristics and modulizing product and services. Designing a cell with life-cycle service vision is a critical activity for successfully implementing a customer case. Key product properties such as the intelligent modularization creating ability to be maintained, upgraded, and reused easily, must be identified.

Efficient Requirements Engineering (RE) process from multiple perspectives is needed. Basic requirements are aimed to be collected from project management (JIRA) and INHANCER using in the first stage QFD- matrix.

 Used QFD method is part of ISO 16355 and ISO 9001[11]. The QFD standard is currently applied for NPD.

The purpose of using Quality Function Deployment within ReconCell is to support and improve decision making in complex agile PSS process. QFD methodology is a systemic, proven means of embedding the Voice of the Customer (VOC) into requirements. ReconCell is a B2B type system delivery process that has four types of types of customers;

- End-customer that invest in the system,

- Customers customer that gives the requirements for the system,

- ReconCell partners that provide and maintain the system and related services,

- ReconCell owners that provide the resources and carry risks

QFD is a method of ensuring that key requirements from different stakeholders are accurately translated into relevant specifications from definition to design, process development and implementation. Therefore, the design has to support;

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[11] https://www.iso.org/standard/62626.html

1. Strategy; Positive business impact (Business view), verified by BIA (Business Impact Analysis)

2. System Life-cycle; Positive process impact (Service view), verified by

3. Operation; Positive operative impact (System view), verified by Verosim

As the business matures QFD can be replaced by an efficient metamodel based Requirement Engineering (RE) tool. There are several alternative tools suitable for complex requirement analysis. However only few of them support parallel design of both technical and business processes.

One good alternative for simultaneous product and service design tool is Brownfield IV.[12]

The different sections of the QFD matrix and a brief description of each are listed below.

- "What's": This column is where the VOC, or the wants and needs, of the customer from INHANCER are listed.

- Importance Factor: The project team should rate each of the functions based on their level of importance to the customer. In many cases, a scale of 1 to 5 is used with 5 representing the highest level of importance.

- "How's" or Ceiling: Contains the design features and technical requirements the product will need to align with the VOC. Basic design features of ReconCell are embedded to the tool by process team.

- Body or Main Room: Within the main body or room of the house of quality the "How's" are ranked according to their correlation or effectiveness of fulfilling each of the "What's". The ranking system used is a set of symbols indicating either a strong, moderate or a weak correlation. A blank box would represent no correlation or influence on meeting the "What", or customer requirement. Each of the symbols represents a numerical value of 0, 1, 3 or 9.

- Roof: This matrix is used to indicate how the design requirements interact with each other. The interrelationships are ratings that range from a strong positive interaction (++) to a strong negative interaction (–) with a blank box indicating no interrelationship.

- Competitor Comparison: This section visualizes a comparison of the competitor's product in regard to fulfilling the "What's". In many cases, a scale of 1 to 5 is used for the ranking, with 5 representing the highest level of customer satisfaction. This section should be completed using direct feedback from customer surveys or other means of data collection. it is maintained by marketing, sales and project teams.

- Relative Importance: This section contains the results of calculating the total of the sums of each column when multiplied by the importance factor. The numerical values are represented as discrete numbers or percentages of the total. The data is useful for ranking each of the "How's" and determining where to allocate the most resources.

- Lower Level / Foundation: This section lists more specific target values for technical specifications relating to the "How's" used to satisfy VOC.

  o Upon completion of the House of Quality, the technical requirements derived from the VOC can then be deployed to the appropriate teams within the organization and populated into the Level 2 QFDs for more detailed analysis. This is the first step in driving the VOC throughout the product or process design process.

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[12] https://cometasolutions.fi

2.4 Business Platform Road Map

The Business Platform and Business Intelligence platform structuring at initial phase was done together with ReconCell partners. As the maturity of the product and services is constantly increasing in quality, and thus allowing for more complex business models, we considered the need for an extensive roadmap for business platform development.

The roadmap should consist of:

1. Business strategy roadmap development using PSS Profiling tool,

    a. Strategy analysis

    b. Analysis for standards and principles

    c. Analysis for PSS Business Model (BM) development.

    d. Road map for value chain development.

2. Business platform roadmap using CSL tool,

    a. Organisation structuring

    b. Product and service structuring

    c. Value chain and core processes structuring

    d. Models and integration

Figure 16: Results of analysis of the ReconCell PSS structuring using CSL and BIA

Requirements for business, strategies and resources that where embedded for the roadmap were collected during development phase through intensive sessions with use cases.

The key collected requirements for the next step are:

1. Product and services need to be divided into independent elements (core and optional). Roadmap includes approaches and tools like the DSM (Dependency Structure Matrix) that represent and navigate across dependencies between components.

2. Product structure and Business Model are to be matched. Relation between product and service structure and value creation has to be transparent. Tools like Adonis BI tool and Foresight PSA tool can be adapted for this purpose.

3. Product and services need to be standardised at process level. However, they need to be planned to be suitably for reconfiguration at design level allowing fast adaptation and simultaneous development. Standardisation and flexible modularization in design process with close collaboration with business platform is needed.

4. Division of responsibilities in the value network and/or ownership (IPR) and contractual polices need to be defined. Innovation management is needed for combining product and service innovations.

The requirements are to be reflected in the design of Business Model, product and services and value chain strategy.

Strategy structuring was done during initial phase based on partners roles and core competences. Value chain tactics at this stage are based on both the current roles of partners and their geographical locations.

ReconCell Business Model was planned together with the use cases in intensive workshops involving the partners and customers. The basic requirements derived from customers focus on creating the ability to provide fast response to assembly line re-configuration needs in volatile production environment. The key offering is a modularized, cost-efficient, re-configurable and fast delivered and ramped-up robot-based assembly system and service platform.

Figure 17: Addressing internal and external barriers

Return of Investment (ROI) gains and investment logic is based on several re-configurations and their cumulative positive cash flow rather than calculating one project's gains. The state-of-the art systems (traditional robot cells and fixed automation offered in the market) do not serve the needs of the SMEs well in terms of quality, cost, flexibility as well as the need of a better use of energy, space and human resources. Therefore, the models need to show the customer the exact benefits in terms of:

1. time to cost, scenario-based cost model

2. time to quality, scenario-based delivery model

3. time to variety (re-configuration, ramp-up)

ReconCell Business Intelligence (BI) roadmap aims at supporting platforms for compelling value offering suitable to SMEs as well as large companies.

Product and service-based business scenarios that need to be modelled are:

- Scenario 1: Changing manual assembly to robot assisted one (basic scenario),

- Scenario 2: Changing fixed assembly automation to a flexible one

- Scenario 3: Solving responsiveness problems of a volatile B2B assembly business by fast ramp-up, scale-up and scale -down services to support customers and customers business. Using leasing would be suitable alternative.

- Scenario 4: Solving complex assembly problems by simulation, analysis and knowledge network to allow novel constructions and full use of methods like 3D printing.

Basic scenario 1: it is the easiest scenario as a basic ROI (Return On Investment) is calculated using cash flow gains over several re-configurations. For the second scenario, one must both estimatestrategic and operational gains. A cost-benefit analysis is needed. For third scenario, we need to assess the capital and resource needs within the internal processes. Internal and external cost-benefit analysis needs to be balanced. For fourth scenario, an extended model for valuing the knowledge as main asset is needed.

Service based business scenarios are;

ReconCell modular design of products and services should allow three alternative business models variants (corresponding to three equivalent Product Service System (PSS) classes (*M Cook (2004)*):

1. Product Oriented PSS: This is a business case where ownership of the tangible cell is transferred to the customer, but additional service packages, such as maintenance contracts, training, up-grading, simulations and module sharing, are provided for. Basic business calculations are sufficient.

2. Use Oriented PSS: This is a business case where ownership of the tangible cell is retained by the ReconCell Ltd, that sells the functions, via modified distribution and payment systems, such as sharing, pooling, and leasing. These models need extensive attentions on resources, financial models and life-cycle models. A balanced cost-benefit analysis is needed.

3. Result Oriented PSS: This is a business case where the solution is maintained as services, such as, for example, contract manufacturing replacing cell delivery. Also operating a cell within customers production is possible in special cases (however not recommended due to high risks involved). The complex calculations needed are not covered within this document.

For Business Model planning, cases can be further categorized by the distinguishing features of delivery:

1. the performance orientation of the dominant revenue mechanism and

2. the degree of integration between product and service elements affecting the resource use and risks and responsibilities.

According to the first distinguishing feature, the business case can be designed and measured as input-based (IB), availability-based (AB), usage-based (UB) or performance-based (PB). The performance-based type can be further subdivided into three subtypes:

1. Solution oriented (PB-SO) BM: (e.g. selling a promised level of configurability and efficiency instead of selling system). This requires extensive use of models and can be only achieved with a mature business platform that has a lot of case-based data.

2. Effect oriented (PB-EO) BM: (e.g. selling a promised level of production in a line instead of selling the line). This model involves deep collaboration with customers and is often an additional service of a sub-contractor that has an own engineering resource, often used in 3D printing business and automotive industry.

3. Demand-fulfillment oriented (PB-DO) BM: (e.g. selling a promised level of quality, delivery, costs and flexibility instead of selling line). Often used within automotive industry. Requires mature business processes and deep strategic integration with customers.

According to the second distinguishing feature, a Business Model can be designated as segregated, semi-integrated, and integrated, depending on what extent the product and service elements (e.g. maintenance service, spare parts) are combined into a single offering.

From a business platform and tool point of view each core business scenario requires developing and implementing equivalent integration strategy and business process that has standardized work flows, resources and tasks.

ReconCell can potentially deliver several services alongside the modular basic product and beyond normal product delivery. However, each of the offered additional processes and services from partners need to be planned, tested, agreed on, described and implemented.

3 Value proposition

Planning and designing of the value proposition requires awareness of markets and the preferences of the potential customers and the composition of potential customer base. For this purpose, the ReconCell business team made several marketing efforts and collected requirements. In order to support marketing, sales and planning of product and services Blue Ocean Robotics developed an appropriate approach, method and supporting web-application called *INHANCER*. This tool supports marketing, sales as well as project and process teams with value proposition and value case planning and development. It uses smart checklists, online questionnaires and can support case-based learning and scenario-based planning. It was developed, tested and planned for designing and handling of basic early stage business planning and management. It increases understanding and quality of value propositions and value cases, aligns sales and product planning, lead evaluation processes planning and business process design and implementation.

This concept innovation process, focuses on studying markets and customers and devising solutions that address unmet desired outcomes, produces multiple promising product and service concepts, and outlines accompanying business cases. Business impact analysis can be made based on the collected market, competitors and customer data.

Using these inputs, process and project teams create projects and services. Detailed design and manufacturing decisions are made during this technical innovation process, which results in a complete and detailed product and process design. Innovation at this stage focuses on determining how a product and service should work and exactly how they should be delivered. The challenge in product and service development is to assure the successful realisation and marketing of the promising concepts. It is here that QFD is used to connect INHANCER- process with product and service planning and realisation.

3.1 Value case

Value case model and corresponding tools are used to assess the revenues, costs and investment needs and roadmap for the chosen business concept. In ReconCell a coalition of interorganizational networks of stakeholders with different value-added and specialty areas try to achieve the commercialization of the core innovation. This cooperation itself increases understanding, communication, and looks for ways to define value across the stakeholders. However, when introducing the created innovations into the market in large scale and involving customer value, cooperation becomes increasingly more difficult.

The basic value cases that are studied using INHANCER, PSS Profiler and Value Case Methodology (VCM) are:

1. The Strategic Case: ensure that the case will meet the stakeholder's strategic needs
2. The Economic Case: ensure valid roadmap to guide the investments and work
3. The Financial Case: ensure credible budget for needed time periods
4. The Commercial Case: ensure creation of valid set of OKRs and KPIs to ensure commercially viable solution to serve stakeholder needs
5. The Management Case: ensure viable project structuring (e.g. with the CSL tool) that ensures effectively delivered project.

Financial metrics are important but not the sole measure of the business success of innovative systems like ReconCell. Besides this financial planning the involvement of multiple stakeholders is critical. All ReconCell stakeholders have individual agendas, starting positions, inputs and interests in the innovation project. Effective collaboration tools and team-work are essential.

The Value Case Methodology (VCM) developed by TNO[13] (Dittrich et al 2013) is embedded in the PSS Profiler and it uses the data from INHANCER. This approach and method were developed for ReconCell to facilitate a multi-stakeholder and multi-value planning environment and to agree and unite along a set of shared values. It does so by making a very broad set of values, which are associated with the innovation. Thereby uniting the motivation, wishes and aligning the different values of all stakeholders involved.

Traditional approaches to investment planning and decisions making for multi-value projects have a strong focus on monetization, i.e. translating non-financial values into cash. However, not all values are easily monetized. The VCM method idea is to make financial as well as non-financial values explicit. It is used in conjunction with INHANCER and PSS profiler for product and service planning and aimed at positive decisions to give the go-ahead for the innovation and customer projects. Once the goals and the project itself are defined, stakeholders are selected and committed, an initial overview of who-does-what is produced.

Iterative steps of VSM using INHANCER and PSS Profiler:

1. Value Identification (Awareness). For each stakeholder the relevant values that the desired innovation project should affect are elicited. A qualitative insight on who gets what values is produced. Methods used are group workshops and advanced interview techniques.
2. Value Quantification. Efficiency based assessment $E = Q/L$ (Q = customer benefits and value processes, can also be understand as Quality, L = loads and resource use also understood as Cost. Who-gets-what and who-does-what are quantified in appropriate units and measurements. QFD can be utilized. In case the distribution and impact of the qualitative values identified cannot be determined unambiguously, additional insights, expert interviews and data analysis are obtained.
3. Value Sensitivity. The range of OKR and KPI for each stakeholder. These are visualised and analysed, resulting in a list of alignment opportunities.

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[13] https://www.tno.nl/en/about-tno/organisation/

4. Value Alignment. A structured QFD process aimed at getting an overall acceptable project definition, based on the alignment opportunities, is performed.

Value Alignment is an iterative process, which terminates when:

1. Agreement is reached and collective action will take place.
2. An alteration of the elements is necessary, resulting in adapted project plan or a different group of stakeholders. As a consequence, some or all steps of the VCM will have to be repeated.
3. No collective action (termination of the project), because no alignment is feasible.

The process focusses on value elicitation and satisfaction of all stakeholders by shaping the joint project and the set of shared OKR and KPIs based on these values.

4   Technology assessment

Technology assessment is a constant process to drive the development of a platform, the tools used and their development done by process teams. It has to balance three dimensions; business, product and service (system) and value stream development. This is consistent with the PSS concept, where the product, services and system are interlinked. Changes in any of those affect the total complex system. The communication between product and service, business and operational process developers and strategists in the organization is facilitated by team work and tools that translate complex set of design rules for integrated PSS Business Model.

The PROTEUS project[14] has developed a system to assess a company's current and future product/service portfolio, through a structured and critical approach that help to identify critical areas for improvement and to evaluate their PSS strategy, with respect to other elements at the company's discretion (e.g. competitors, customers, suppliers and customer's customers), and based on these considerations devise how competitive strategies affect the system modularity and complexity. There are several re-configurations of the systems and tools during a business system life-cycle and the organisation keeps evolving and learning. There are also constantly evolving new business models, products and services that offer increasing possibilities for business impact.

There are several external platforms that provide services suitable for ReconCell that need to be assessed and considered to be integrated into a platform. For example:

1. PROTEUS (PROduct/service-system Tools for Ensuring User-oriented Service) is a recently completed innovation consortium, with a deep focus on developing new knowledge about how after-sales service can be effectively integrated into product- and business development, so as to become a source of revenue, rather than a cost to the providing company. (http://www.proteus.dtu.dk/)

2. PROMIS® is the result of European funded research, development and innovation. It is a Cloud/SaaS and Intranet Business Intelligence and Open Innovation eco-system of interactive services that allows organizations and institutions to find their way in the maze of legal, standards, norms and other regulations. (https://www.promis.eu/eu/)

3. DBE Core, The Digital Business Ecosystem is an open development platform that aims to create new value by integrating supply chain processes and data. It enables the integration of business processes by the aid of API integration. It can be widely used in the areas of sales, sourcing, procurement, logistics and transaction-based financing. (https://dbecore.com/)

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[14] http://www.proteus.dtu.dk/

ReconCell needs a method to improve its strategy and framework constantly and develop transparent processes and models describing how internal and external partners join the network, share responsibilities and how IPRs and risks are managed, and value is generated. Only by efficient transparent platform development teams and learning, ReconCell will be able to follow the processes and respond quickly to opportunities and evolving customer demands.

4.1 Business Impact Analysis (BIA) principles and tools

Analysing the business results of the product and service development is important for clarifying the rationality of the chosen product and service partitioning as well as business, system and product architecture logic. Activity Based Costing (ABC) should be adapted to estimate the cost savings due to reduced activities. Similarly process-based cost reduction and modelling and market segment perspectives are used to clarify time, quality and flexibility impacts. The purpose of BIA (Business Impact Analysis) is to give a rough estimate about market and profit influence of the decisions. BIA is supported by a model that describes relations between key engineering concepts, services and competences.

The metrics suited for measuring business performance are usually based on assessing benefits vs costs and integration efficiency. Metrics based on changes in benefits (Q; quality and flexibility) and Loads (L; cost, time, waste) lead on maximizing Q (Quality)and minimizing L (load) factors. We express values first in qualitative terms and change them to absolute quantities using QFD by identifying ways to reduce costs or in relations where several gains are achieved for instance a short delivery has multiple effects. In order to make a comparison between alternative concepts in different scenarios, it is important to translate all kind of effort into some cost, time quality and flexibility equivalents. For reconfigurable systems, cumulative positive cashflow and strategic improvement of competitiveness are the main factors. Therefore, predictive long-term models are needed.

ReconCell system investment is a strategic decision that balances the short-term goal with the longer-term goal of improved agile business process for competitive advantage. ROI calculations in ReconCell case is based on modelling long term positive cash flow during the service life of the system and the reduced reconfiguring costs and added sales. The business case for ReconCell is based on getting an advance cost-efficient capacity rapid ramp-up and quality job with fast reconfiguration to any new products.

Selected analysis models measure impact of:

- labour savings,
- positive cashflow over the system's service life and compare
- low system acquisition costs,
- Low life-cycle costs compared to conventional robotics and fixed automation.

ROI (Return of Investment) calculator (Done by BOR)	Calculates Return of Invest by comparing two cases	Excel
Case calculator (Done by BOR)	Investment planning and calculations for business models - labour savings, - cashflow over the system's service life - system acquisition costs, - life-cycle use costs	Excel

Service template (Done by BOR)	Service offerings table - services - costs - providers	Excel
PROTEUS PSS Planning tools (Done in PROTEUS project)	Tool for strategic selection of services http://www.proteus.dtu.dk/	WEB

Table 2: ReconCell tools for investment planning support

In a traditional integrated turnkey system, the robot is about one-third of the cost of the total installation. Re-configurable system brings savings in design, tooling, safety guarding, conveyors, integration services, programming and installation. Payback time of conventional robotics is generally from one to two years when compared to low-cost labour and time to quality and cost times exceeds often the needed response time.

With the ReconCell case it is important to estimate positive cumulative cashflow based on cheap basic system and low reconfigurability costs and aim at fast set-up and short time to quality and cost. Positive cashflow can be seen from the initial investment over several product generations and if re-configuring is fast, cheap and easy the case against cheap manual labour can be presented.

During the first phase we suggest using a simple excel tools developed by BOR for calculations and PROTEUS tools[15] (for PSS concept development of the product, services and processes). For the next phase roadmap, more advanced metamodel and process-based tools are to be used such as ADOSCORE[16] that allows dynamic business impact calculations. At this point static calculations are adequate.

Wastes and defects are also prime motivators for investing in assembly automation. They are easy to understand, however, waste and defects occurring in a complex manual assembly process are strongly interrelated. Even if one applies a root cause analysis, there are cases where defects do not stem from one root cause only, and one root cause may be responsible for many defects.

Any activity that consumes resources without creating value for the customer should be considered as waste. Within this general category it is useful to distinguish between those activities that cannot be eliminated by ReconCell, and those consisting of activities that can be eliminated. An example of type one is any rework operation do to material quality and example of type two is multiple movements of products and inventories between steps in a fabrication and assembly process.

Unevenness is a typical problem in manual processes that is eliminated by ReconCell through consistent operations and careful attention to the integration of work. Capacity optimization from a business point of view goes beyond the aim of mere capacity maximization connecting it to profitability and value creation. The cost of idle capacity is defined as unused capacity or production potential and can be measured in several ways: amount of production, available time of manufacturing, etc.

OKR or "Objectives and Key Results" is a goal-setting framework that aims at balancing system design goals from multiple perspectives. Key OKR cover business, technical and process OKRs.

Business based OKRs aim to make the business goals transparent and mutually accepted and understood. For each OKR, there is an Objective to be achieved, along with a set of metrics that will measure they

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[15] http://www.proteus.dtu.dk/results/tools/pss_configurator(1))

[16] https://uk.boc-group.com/adoscore/

achievement of that Objective, called Key Results. For measuring the achievement of Key Results there is a set of KPI or "Key Performance Indicators" that determines factors needed to achieve success.

Objectives and Key Results (OKR) may not directly include a KPI that follows a specific metric. These are referred to as a "milestone goal." These concepts can be measured based on whether they've been completed.

Target metrics are used for instance prizing and delivery times. The definition of suitable KPIs use S.M.A.R.T. criteria: each KPI has to be Specific, Measurable, Aligned, Relevant, and Time-based (Doran, 1981).

Basic Metrics:

1. Threshold Metrics – These metrics represent a range for which you can aim; falling anywhere in between this range would be acceptable.

2. Baseline Metrics – These represent the number that is considered acceptable; achieving anything less would be considered "missed."

3. Positive and Negative Metrics – increase benefits and simultaneously decrease wastes and loads.

OKR and KPIs are defined for each project and process during workshops with teams. We use the profiler for aligning the OKRs and KPIs with the project goals.

Activity loop for setting OKRs by using PSS profiler for each project and process is:

1	Objectives are defined	INTENTION process
2	Key results are defined and committed to	GOALS and KPI strategy process
3	Planning to meet the targets	CONCEPT process
4	System KPIs implemented	CONTROL process
5	KPI knowledge gathered and decisions made	ANALYSIS process
6	Objectives revised	NEW INTENTION

OKRs are directly tied to KPIs. To illustrate, suppose a company has the objective: "Achieve Productivity Increase Targets for a specific project" with the following key results:

OKR = Double capacity usage of critical resource to 60%	KPI = capacity usage
OKR = Increase throughput time to 40 min/step	KPI = Throughput time
OKR = Decrease extra work from existing to zero	KPI = Extra work
OKR = Decrease set-up costs from existing to 10%	KPI = Set-up cost
OKR = Decrease programming time to close zero	KPI = programming time
OKR = reduce time for new product to 30 min	Time to variety
OKR = Total investment 100 000 euro	KPI = target price
OKR = Production start on specific date	KPI = critical path time
OKR = Reduction of scrap to close zero	KPI = yield

Setting up the OKRs and KPIs is done along the project planning on Cost, Time, Quality and Flexibility basis. For instance, relevant time based KPIs for different business processes are:

New Product Development (**NPD**)	Time to Market
New Product Introduction (**NPI**)	Time to Market
Order-Delivery (OD)	Time to Quality
OD Cost reduction	Time to Cost
OD Flexibility	Time to Ramp-up
OD Implementation	Time to Volume
OD Training	Time to Skill

We used Excel platform developed by BOR and tested the business case. The processes learn from experience and improvement targets can be made based on follow-up analyses. In the long run ReconCell will have a lot of overlapping projects on different life-cycle phases. There are emerging new projects, up-scaling active projects and down-scaling projects. Each of these project types will have a specific set of OKRs and KPIs depending on their life -cycle phase.
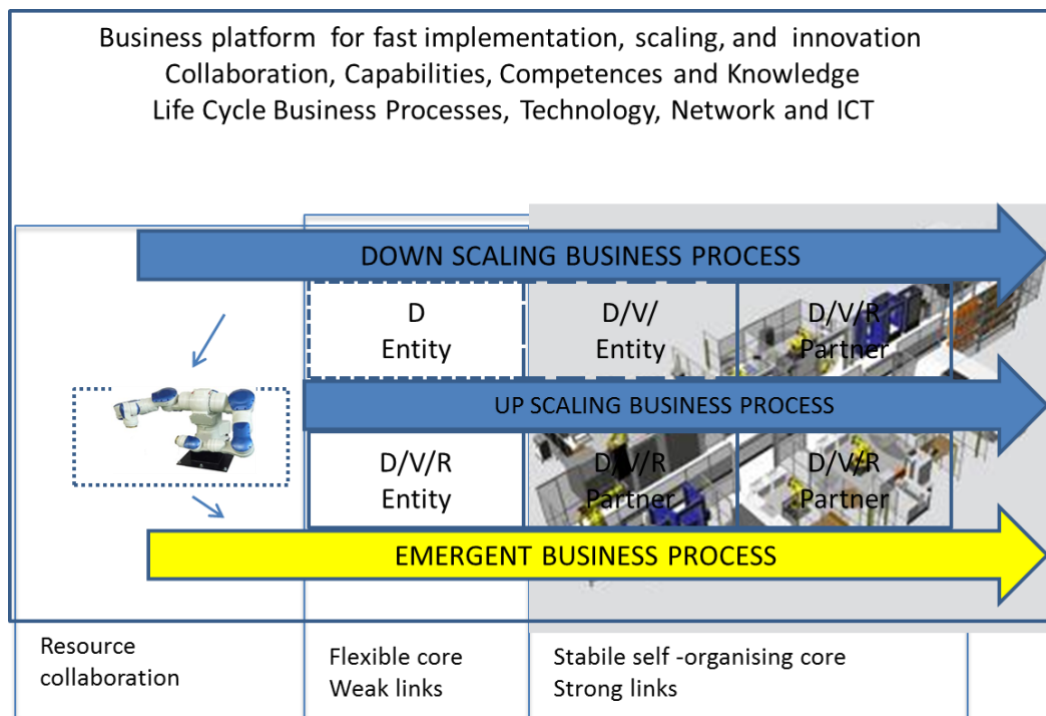

Figure 18: Parallel design and planning of multiple processes

There is a strong link with OKR and the life-cycle phase of the PSS business model. When a case is emerging, the main tool for collecting OKR is INHANCER and customer requirements are adapted with the possibilities using pre-planned value offerings and existing models. Up-scaling of a system already in use is faster and the amount of available information and smooth ways of collaboration reduces costs, time and improves quality. The primary source of OKRs is INHANCER and the teams.

Downscaling involves planning the re-use of the system and components either within the same or other customer processes and for these cases we can use reverse QFD and balance OKR and KPI from both sources. All these scenarios involve extensive use of models, collaboration, knowledge and project planning. Key processes should be polished, and knowledge well maintained to ensure the successful achievement of goals and learning and improvement of processes.

5   Roadmap

Implementing the envisioned advanced business platform and planning corresponding business intelligence system for complex business environment along the vision and strategy proved not be a simple task. Within ReconCell type multi-stakeholder network duration and the nature of relationship with internal and external partners is going to vary from short to long term or from price based to strategic based, as well as composition and structure of the value networks in terms of typologies of actors (suppliers and partners).

The roadmap and vision for second phase Product Service System PSS platform is based on outcomes of value case-based planning for improved possibilities and advancements. Implementation of modern BI platforms help to develop and integrate the key partners processes and allow partly automate them for better response and knowledge re-use. It is closely tied in development of roles and resources. The aim is to address found

gaps in key resources; network, product and service processes, technology and ICT. Limiting factors and barriers are related to missing capabilities, competences, collaboration and knowledge.

Products, services and the processes should be re-planned carefully and configured according to tested selected business scenarios and business cases and processes should be described in the same way as product and service specifications. This learning phase is vital for planning and implementing envisioned advanced agile environments for fast response to open up market windows for customers. Quick decisions support and added Business Model alternatives can be provided for both customers and the teams. Strategic fit, profitability, cost efficiency and competitiveness are as important to all stakeholders and balancing them over projects is vital.
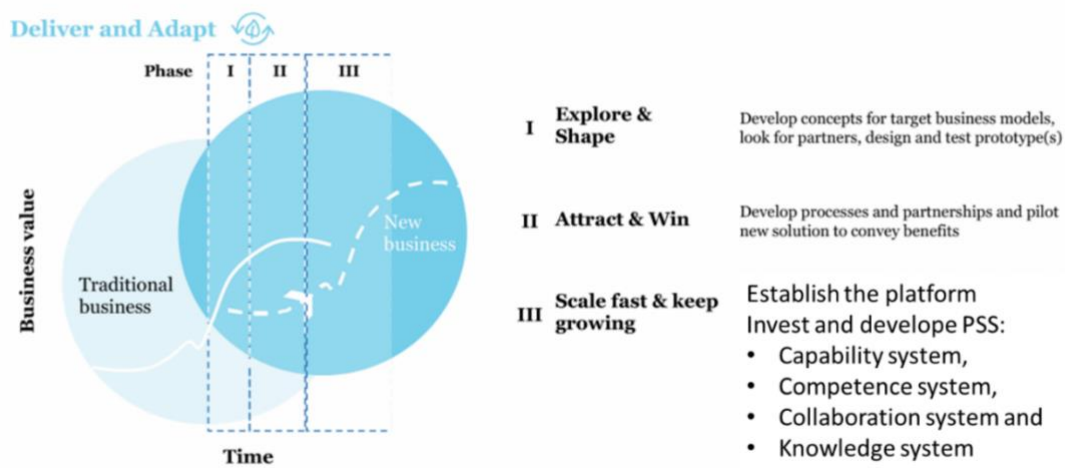

Figure 19: Transition process towards second phase PSS

Transition process consists of the following phases

- Development of concepts for target Business Models. Selection of partners and design and test platform.

- Development of business processes and partnerships and pilot the solutions and evaluate the business impact.

- Establishing the platform and evolving it using learning.

 The second phase implementation roadmap is discussed closer in the following chapter.

Shared advanced approaches, tools and processes are needed to coordinate the relationships and share the right information efficiently in the network. A crucial aspect to consider in evolving PSS is the extent to which a provider has to share data, information and models with its partners in order to enable a more efficient and effective creation and delivery of value and strengthen relationships.

Transition to the second phase platform requires careful planning and roadmapping for covering the capability gap. The needs were outlined using the test cases as scenarios. The transition process is planned to be performed in three steps (*Figure 19*).

5.1 Barriers

The barriers for implementing the advanced process-based business platform are related to maturity of the business model, business processes and business case itself. Therefore, the second step system can only be implemented after the first step is fully functional and there is a strategic need for a more advanced platform. This roadmap covers the needed phases for transition from project to process based business platform.
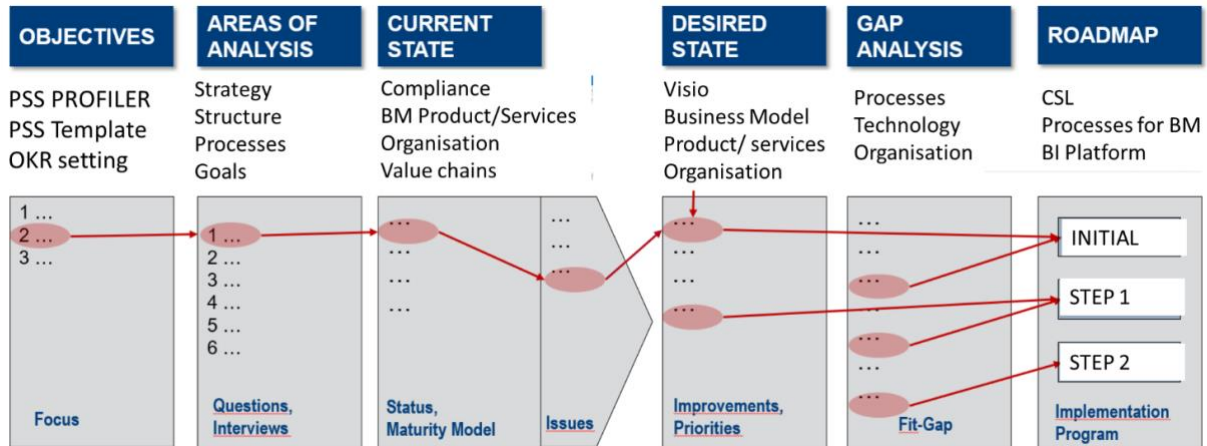

Figure 20: Implementation programme towards second step PSS

5.2 Implementation, Second phase Product and Service structuring tools

Product and service structuring from business point of view is not yet strategically performed. Supporting complex product structuring decisions of the business impact in complex project-based environments is a vital task. One suitable support tool alternative is Soley Studio[17]. It allows multiple analyses and automated operations using a work flow-based approach. It can be used to help on complex decisions supporting sales, design, manufacturing, implementation and aftersales.

There are also more advanced tools based on metamodeling under research. We tested one of those that is currently being developed within Tampere University of Technology and can also be used for Business Impact Analysis. The tested tool is called Brownfield gen IV[18]. These types of tools have grooving importance as the business takes off and the product/service portfolio grows more complex. There is a significant impact on business if the product and services are well-structured and standardized.

5.3 Implementation, Advanced Business Intelligence tools BI

Second phase Business platform requires an advanced Business Intelligence (BI) platform. It helps to improve collaboration and information flow. BI is about making business processes visible, transparent and predictable. It is based on collecting data from both internal systems and customer's sources, prepare it for analysis, develop and run queries against that data, and create reports, dashboards and data visualizations to make the analytical results available to teams, as well as customers. In the initial phase we used the basic project management tool JIRA in combination with Google spreadsheets and the INHANCER tool for mapping

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[17] https://www.soley.io/en/

[18] https://worksite.cometasolutions.fi

processes, organization, tasks and costs with data provided by the partner's administrative systems. Each partner used at this stage their own BI tools processes and approaches.

For the second phase platform the product and services need to be planned towards the business impact. The processes need to be standardized and implemented over the platform using the standard BPML 2.0 description. This allows the implementation of more advanced AI based tools supporting learning (PSA, BI or ERP based).

ReconCell aims to focus on the competition with fast response for demanding customer needs. Finding and allocating the right resources for each project team within ReconCell type of Virtual Enterprise platform and resource pool is not a simple task. The ReconCell consortium consists of SMEs, universities and research institutes and thus needs an efficient scenario and learning based (AI supported) management system. A modern PSA (Professional Service Automation) type business software is the best alternative for the second stage. It can be used to compensate the lack of ERP systems to maintain, process and present the project data in a customized way, and also assist in taking action based on this processed data.

Supported by a PSA system ReconCell can operate based on data from previous projects and build scenario-based models. Project teams can then give an estimate of time, resources needed, and budget allocations across the organization. Making a precise time, cost and capacity estimate is possible by looking at previous experience or scenario-based models associated with the particular task. Based on content of the standardized task and the project or customer it is related to, among other factors, it is possible to give estimations for new cases based on previous experience with other cases across business.

ReconCell has currently only data from the test cases so an AI-supported system is not yet needed to understand on-going processes, and give the perspective, whether actions are needed on costs, the timeline and roadmap, or scheduling of resources.

5.4 Implementation, Process design and documentation tools

Second phase business platform idea is based on the process management paradigm instead of the previous project-based approach. This is a holistic view of the business as a system focused on specific outcomes achieved through a sequence of tasks that form manageable flows and allow for understanding, measuring and developing them. All commercial BI tools have efficient environments to define and manage processes. We used ADONIS BI[19] to design a suitable system supporting the future business process landscape. Current (AS-IS) as well as future (TO-BE) processes and for them assigned organisational responsibilities are described. With the efficient process modelling tools that use standard BPML 2.0 transparency and compatibility is ensured for the entire value chain. The environment allows also the description of dependencies on IT, services, products, and the use of documents and resources as well as validation of the organisational structure. Basic added functionalities needed and planned for further development of platform are:

1. Process-based Work Instructions.

2. Quality and Audit Management.

3. Compliance Management

4. Internal Control/Risk Management

5. Process analysis and optimization

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[19] https://us.boc-group.com/adonis/

6. Activity-Based Costing module

7. Process-based Human Resource Demand Forecasting

8. Technical Execution of Processes

9. Process Performance Measurement (OKR based KPI & Process Performance)

10. Goal-oriented BPM

There is a clear need for a shared process-based business platform.

ReconCell second phase Product and Service (PSS) platform idea for second step platform consists of various modules to allow consistent structuring and management of business environment. The implementation of the roadmap is a step by step process. It needs a solid strategy, structuring and design of the product, services, organization, value chains and careful selection of tools to allow consistent growth.
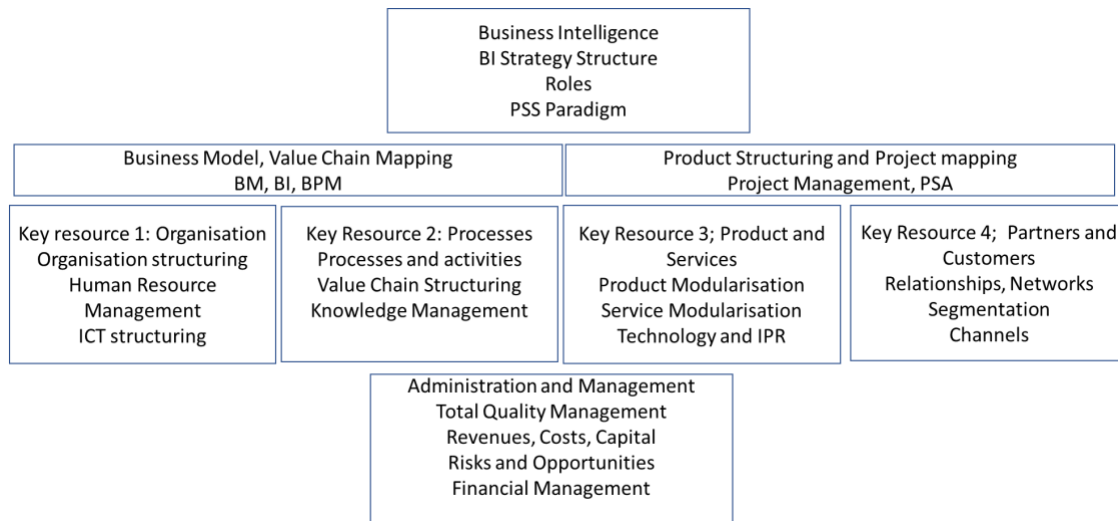

Figure 21: Transition process towards second phase PSS

The envisioned next step for the PSS business platform is to modularize it strategically according to agile and flexible virtual enterprise model. Its processes are aimed to be built using standard approaches that support the PSS BM and state-of-the-art tools that can be easily integrated and expanded. Using ISO standard and de-facto approaches compatibility with most of the commercial state-of-the-art soft- and hardware tools is achieved. The selected approach allows flexible integration and transparent information, work and knowledge flow. The platform allows also integration with different level maturity systems and partners.

Basic development tools, methods and approaches are the same as within first stage platform development and the guidelines and roadmap for building more advanced systems are planned to be developed as part of the planning process.

Strategy process is done using the same PSS Profiling tool in combination with Proteus PSS tools that are used during the first stage. The task is done by questionnaires and discussions with partners based on experiences from the first stage. For the strategic transition towards a more advanced system, a business plan has been made, and the partners have signed a "Letter of Interest" to indicate that they will be interested in joining one of the development teams and take a specific role. For the resource allocation, product and services are mapped.

For building the scenario-based business models, processes are prepared and tested. Sales and marketing teams use *INHANCER*. Integration with PSS business model that currently is done using MS EXCEL based QFD tools will be changed into model-based Requirement Engineering (RE) approach. Within this model-based approach it is possible to link the business processes to requirements and thus increase the response time.

Value chains for different customer cases are mapped using core business processes. The applied tool for value chain design is Adonis. Strategic business alternatives that need an efficient business platform:

1. Based on ownership of the product; transfer of ownership, leasing or contract manufacturing

2. Based on usage of the services; design, implementation, use and reconfiguring services

3. Based on Roles; customer, partner, sub-contractor, investor

From a product and service perspective, the value creation occurs when the customer uses the cell, a service or any combination of service portfolio. The product and service portfolio allow mapping the offerings over selected business model variants and customers.

We used PROTEUS PSS Configurator[20] to support the planning and design of ReconCell PSS solutions next phase modules. The tool is simple and intuitive and gives a good assistance in evaluating the necessary recommended, possible and necessary value offerings and configure a more complex Business Model concept.

The following scenarios present the overview of the studied possible activities and tools that are of interest for the concept of a Product-Service System

- Selling system solutions. This covers the key processes. The SME customers generally do not have resources to perform the system integration and ramp-up. As the they are usually sub-contractors their willingness to carry the risks related to achieving time to quality and time to cost requirements is low

- Service integration

- Leasing or renting of system and/or components

- Pooling/sharing of components like grippers

- Design Structure Matrix (DSM) or Multiple Domain Matrix (MDM)

- Cost Benefit analysis extension to Least cost planning (LCPM)

- Life Cycle Business beyond Re-configuration; 3R, Re-design, Re-manufacturing, Re- cycling activities

- Extending design phase into use phase and introducing knowledge sharing

Additional service possibilities studied as opportunities;

- Outsourcing manufacturing for customers

- Distance monitoring of system and performance

- Remote control

- Application feedback

- Network expertise sharing

- Financial services for various stakeholders

Key resources required to make each business model work are humans, both ICT and financial ones. Therefore, they need to be considered and managed simultaneously. Well-structured value chains that cover

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[20] http://www.proteus.dtu.dk/Results/Tools/pss_configurator(1)#!/28

creation and delivery to different customer segments, reach adequate markets, maintain relationships with customers and suppliers, and make revenues visible are necessary.

Mapping of key resources that are needed depending on the type of business model used in various customer case are currently done project based using a platform that combines project management software JIRA and *INHANCER* tool.

Business process descriptions make revenue visible and the tasks and use of the resources make costs transparent (Activity Based Costing, (ABC)). This makes it possible to make a fast analysis of business efficiency, at the first stage we are using an Excel based ROI calculator and, in the future, an AI-based system.

In those ReconCell cases where selected BM is shifting from ownership-oriented to more service-oriented business models the process can show where more financial resources are needed and how to enable this change in revenue model as the payback period will be longer. The main source of revenues in PSS tend to shift towards services as the customers get used to it and learn to trust it. For customers concentrating on their core business, later phases emphasize the total life-cycle of the cell delivery.

The tenders are usually international, and the stakeholders and parties involved are from different countries. The most widespread types of contract are Engineering, Procurement and Construction (EPC) ones. With an EPC contract, the main contractor undertakes to deliver a whole system and services to the client and carry out all the pre-commissioning activities. The contractor therefore takes the responsibility for the production process, and at the same time bears the risks and covers the total costs of any consequences deriving from both internal and external mistakes or delays. The parties representing the client are offered engineering and procurement as using both internal resources and networks external partners (and sub-contractors). A project organization representing the contractor procures the resources, the most important of which are the materials and specialized supplies (above all grippers, tools and fixtures) the robot arms, vision system etc. Since in agile projects customers consider time as a resource, they will encourage the contractor to reduce the project duration since the time factor plays an important role in generating profit.

5.5 Implementing knowledge management (KM)

The installed ReconCell as system represents a unique asset for manufacturing customers, and thus managing the information, especially those embedded into customer specific models, is sensitive as it presents valuable customer knowledge and is the core of business intelligence. Case data allows forming critical insights about the operations of the cell enabling improvements in both, the system and PSS business model. The level of data and of control that both companies have on data and information generated by the customer case during the use of the product is crucial stressing the importance of high-quality BI system and security management.

Knowledge management within ReconCell is embedded into the projects, processes and models. These are developed and managed by the process team and used by project and process teams for each case. Efficient PSA tool that is JIRA compatible like Forecast[21] can be used to integrate the models. An efficient BI tool is the best alternative for KM as the knowledge can be embedded into processes.

6 Conclusion

ReconCell Business platform and business processes are still at a planning stage. The potential of the chosen PSS approach and interaction of created product, service and business models has been shown and there is

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[21] https://www.forecast.app/

solid market potential. The use cases during the ReconCell project have given the basic data to allow the creation of a detailed roadmap on how a complete business platform for the future ReconCell company could look like. There is a multitude of different business intelligence software on the market and in use by the partners, thus the integration of them into an agile business platform that is suitable for ReconCell type of business case proved to be challenging. The future ReconCell company needs to use this knowledge and balance each individual customer's need as well as the company's ability to support different software in an agile product development environment.

Glossary

ABC - Activity Based Costing

BI - Business Intelligence

BIA - Business Impact Analysis

BPML 2.0 - Business Process Planning tool that uses standard modelling language

CSL - Company Strategic Landscaping

DSM – Dependency/Design Structure Matrix

EPC - Engineering, Procurement and Construction

ERP - Enterprise Resource Planning

KM - Knowledge Management

KPI - Key Performance Indicators

LCPM - Least Cost planning management

MDM - Multiple Domain Matrix

NPD - New Product Development

NPI - New Product Introduction

OKR - Objective and Key Results

PSA - Professional Services Automation

PSS - Product and Service Systems

QFD - Quality Function Deployment

RE - Requirement Engineering

VCM - Value Case Methodology

VSM - Viable System Model

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APPENDIX 1

Setting up PSS Profiler

PSS profiler is a tool for strategic business process planning. It is made in MS Excel and is available from Hermia.
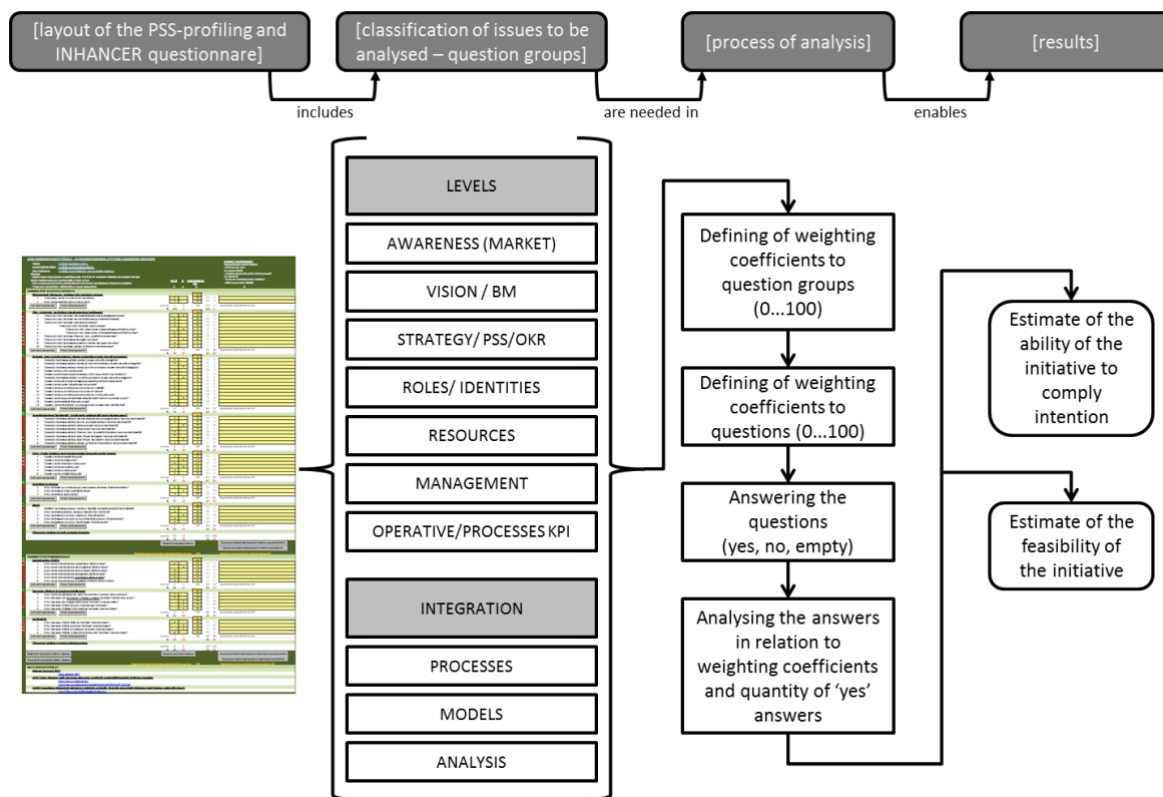

Figure 22: Business Model PSS Profiling tool structure (Salminen et al., 2012)

This Excel based PSS Profiling tool is easy to set up and self-explaining. It helps to form a quick idea of various Business Model alternatives, their weaknesses and helps to assess the maturity of the current systems. The tool is developed and provided by Hermia Group and its set-up and use is trained during case workshops and offered as a service.

For those partners that use Balance Score Carding (BSC) system, the tool includes an additional BSC table to assist their business requirements analysis.

Use of the PSS Profiler

PSS Profiler is used first for the Business Model (BM) as all the partners and customers are joining to network according to chosen BM alternative. The next step is to align customer needs and requirements and develop goals, objectives and KPIs.

PSS Profiling tool includes two evaluation areas: first the assessment of the ability of the project to fulfil complex intention and second the assessment of feasibility of the project.

Evaluation areas include questions which are answered 'yes' or 'no'. Weighting coefficients can be used both to group of questions and to separate questions. The tool offers a quick check list to observe the balance of the complex system and make road map for integration.

Results of the evaluation are calculated based on the quantity of 'yes' answers in relation to weighting coefficients of certain questions and question groups. The contents are general, not case specific. This means that the tool can be used in several different cases to evaluate both small and large initiatives.

Evaluation of intent includes questions related to awareness, vision, strategy, identities and roles, paradigm and values, resources and management of development, realization, implementation and use.

Awareness level

Awareness level questions asses how well the initiative is able to meet the requirements derived from higher strategies (markets, customers, customers' customers, growth, etc.).

Vision level

In Vision level questions are covering the wanted outlook. They should consider technical systems, source of knowledge, applications and processes, logistics, economy, already available resources by customers, and possible service and business solutions.

Strategy level

The ability of the initiative to support the complex strategy system of all stakeholders is evaluated next. Strategy questions consists of issues within processes covering; services, safety, goals, training and culture, competences, business models, lines and factory, unifying of system structure, sustainable forms of business and readiness for change.

Identity and role level

Identity and roles level cover both organization and technical units as autonomous design artefacts (physical, digital and virtual). The adding or removal of any role needs comprehensive analysis of influence in total performance of the system.

Paradigm and values

Questions of used paradigm and values asses the logic of the system design. ReconCell PSS operate on agile paradigm. The fundamental aspect of Agile paradigm is that it is iterative and incremental. The Agile paradigm consists of short well-defined spans of work time called iterations or in project management sprints.

Resource level

Main resources are human, technical components, energy, financing, knowledge, information, trust etc. It is important to cover the exact key resources for each case. Development and realization of the initiative on business perspective is analysed from the available key resources, information, models and experiences. Focus is on missing information and resources.

Management and control level

Management and control level questions concentrate on management models and process configurations. Experiences of similar initiatives and simulation results help to make estimates on controllability of the system.

Operative level

Questions of operative level include issues within missing information from use perspective; risks, maintenance, reconfiguration, refurbishing and recycling.

Evaluation of feasibility from point of view of ReconCell includes additional questions related to expected performance. Feasibility evaluation is based on social, technological, economical, ecological, political and legislative aspects. Sufficiency of the resources and possibilities to meet complex requirements are estimated as well as conformity to law, availability of processes to cover the entire life cycle, technological premises and sufficiency of the network and information to realize the initiative. Performance evaluation consists of knowledge, capability, competence and collaboration needs evaluation.

Economic aspects are evaluated using Return of Investment (ROI), cost benefit analysis and selected set of Key Performance Indicators (KPI) for profitability, productivity, cash flow, capital use and other objectives.

Balance Score Card (BSC)

The Profiling tool has additional Balance Score Card (BSC) view to integrate with customers using BSC system. The Balanced Scorecard is a common framework of larger companies to implement and manage their strategy. It links a vision to strategic objectives, measures, targets, and initiatives and balances financial measures with performance measures and objectives related to all other parts of their organisation. BSC was originally published in (Kaplan & Norton, 1992).

The tool and training is available from Hermia Group.

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APPENDIX 2

Roadmap for Integrating INHANCER and ADONIS BI tools using HoQ and QFD.

During the build-up phase, ReconCell does not yet have standardized business processes, Product and Service System is not yet planned as a solid business platform. Requirement Engineering at this phase is done using information from INHANCER and QFD matrix. The House of Quality (HoQ) is a tool for the process team used to translate what the customer wants and needs into product and service structuring and utilizing a relationship matrix.
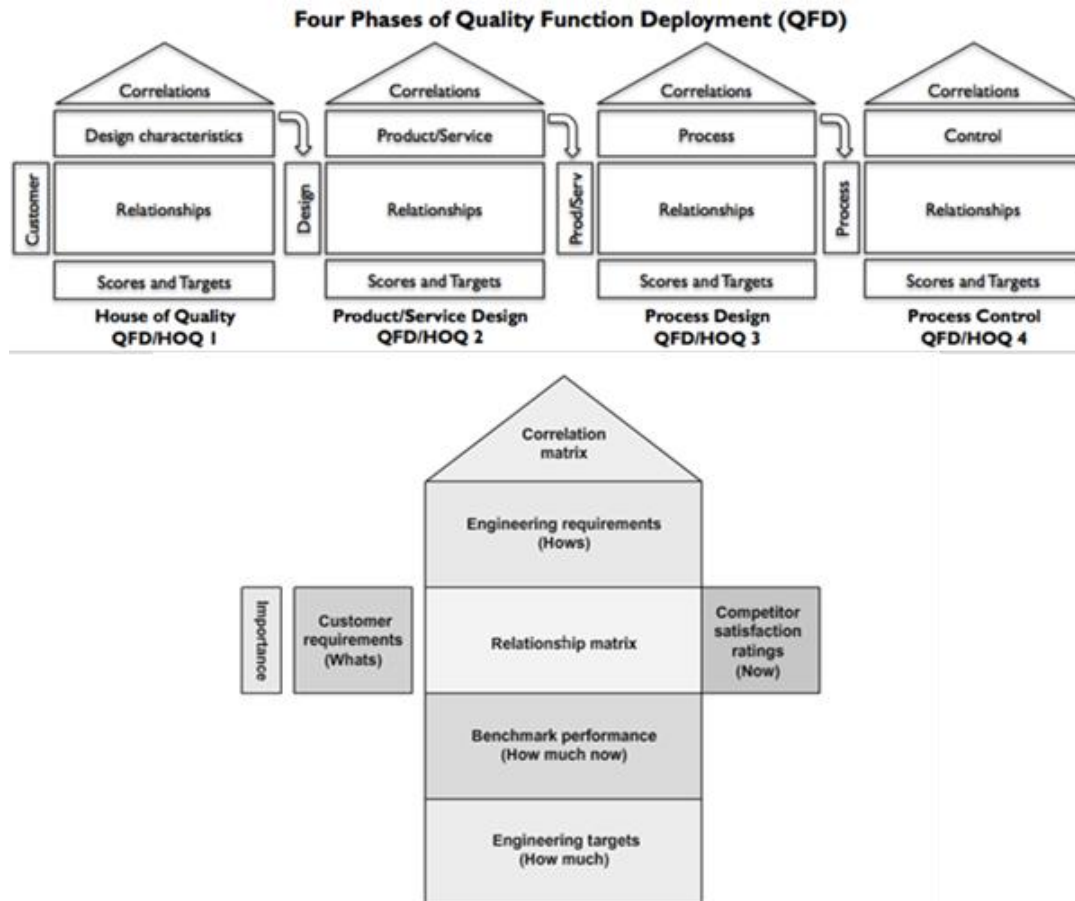

Figure 23: House of the Quality (HoQ) and Quality Function Deployment (QFD) (ISO 16355), https://www.iso.org/standard/62626.html
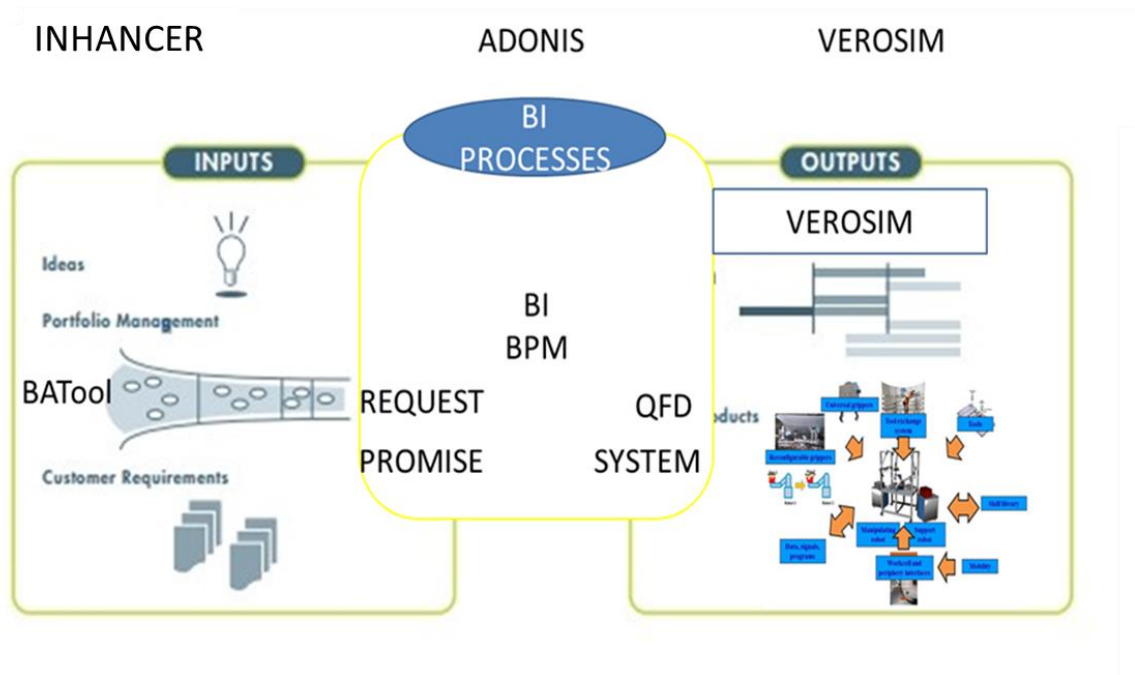
Figure 24: Linking request and promise with system specification using QFD

INHANCER and process-based ADONIS BI tool integration is done by adding both customer requirements as What's /requests and system key features as How's /promise referring to processes.

Setting of QFD matrix

Level 1 QFD

Sales and project teams use the first matrix in the QFD process (see Figure 23). The House of Quality demonstrates the relationship between what the customer wants or request "What's" and the design parameters or key features "How's" in corresponding conceptual levels.
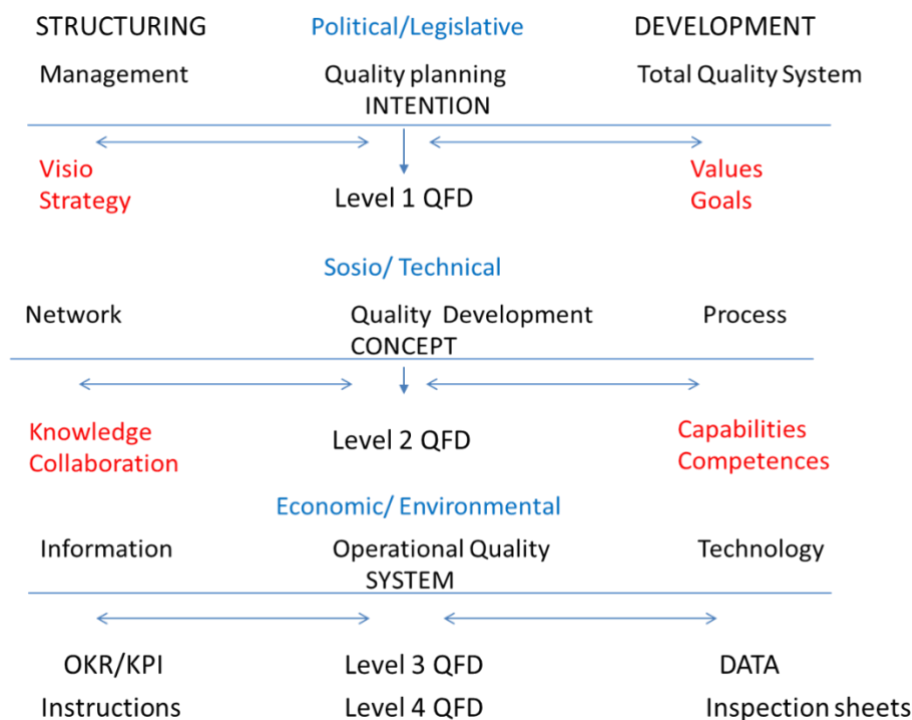

Figure 25: QFD levels and their relation to business system layers.

Level 2 QFD

The Level 2 QFD matrix is used by Project and Process Team during the Design Development Phase supported by Verosim digital twin. Using the Level 2 QFD, the teams can discuss and discover which of the assemblies, systems, sub-systems and components should include product design and work out the fit between requirements and key design characteristics. The information produced from performing a Level 2 QFD can be a direct input to the Design Failure Mode and Effects Analysis (DFMEA) and business impact analysis (BIA) process.
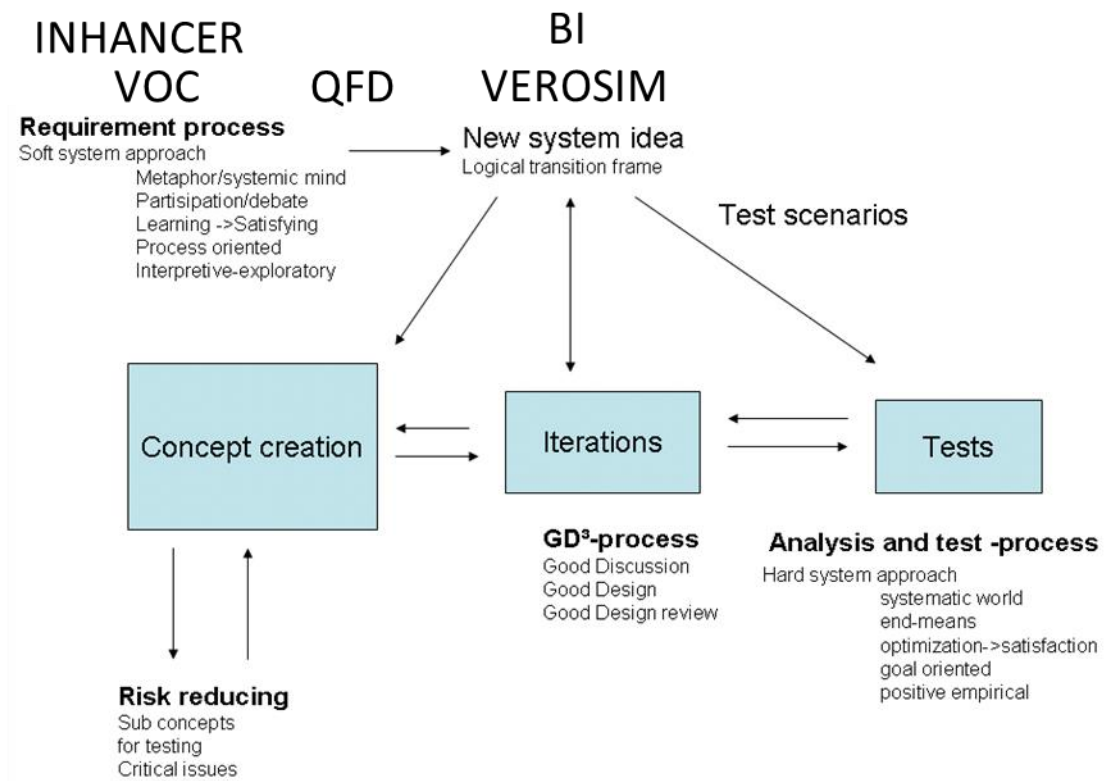

Figure 26: Integrating process and project teams with QFD

Level 2 QFDs is used by process and project teams at the following levels:

- System Level: The technical specifications and functional requirements or "How's" identified and prioritized within The House of Quality become the "What's" for the system level QFD. They are then evaluated according to which of the systems or assemblies and what business needs they impact. Any systems deemed critical would then progress to a sub-system QFD.

- Sub-system Level: The requirements cascaded down from the system level are re-defined to align with how the sub-system contributes to the system meeting its functional requirements. This information then becomes the "What's" for the QFD and the components and other possible "How's" are listed and ranked to determine the critical components. The components deemed critical would then require progression to a component level QFD.

- Component Level: The component level QFD is extremely helpful in identifying the key and critical characteristics or features that can be detailed in the drawings. The key or critical characteristics then flow down into the Level 3 QFD activities for use during the design process. For purchased components, this information is valuable for communicating key and critical characteristics to

suppliers during sourcing negotiations and as an input to the Production Part Approval Process (PPAP) submission.

Level 3 QFD

The Level 3 QFD is used by the Process Team during the Technical and Business Process Development Phase where we examine which of the processes or process steps have a correlation to meeting the business, component or part specifications.

In the Level 3 QFD matrix,

- the "What's" are the specifications and

- the "How's" are the processes or process steps involved.

The matrix highlights which of the processes or process steps have the most impact on meeting specifications. This information allows the process team to focus on the Critical to Quality (CTQ) processes, which flow down into the Level 4 QFD for further examination.

Level 4 QFD

Within the Level 4 QFD matrix, the Process Team should list;

- "What's" the critical processes or process characteristics in the column on the left and then determine

- "How's" for assuring quality and list them across the top of the matrix.

Through ranking of the interactions of the "What's" and the "How's", the team can determine which controls could be most useful and develop quality targets. This information may also be used for creating instructions, inspection sheets or as an input to control plans[22].

Basic information of customer requirements come from INHANCER web tool developed by BOR, aimed at providing ReconCell a business assessment and solution selling processes assistant in early stages of automation decisions. It is planned, designed and implemented as an integrated service for system. It supports both a company internally (sales and marketing and system design and delivery) and externally (the user with acquisition, adaptation, use and re-configurations).

INHANCER is made as an assisting tool for defining and orchestrating the business project by connecting end-users' decisions, information and knowledge timely and accurately with the ReconCell process. It is aimed at customer collaboration with sales and forming all vital data about how an envisioned solution by future end-user (manufacturing companies) can be supported to meet their goals by configuring and integrating the solution. It assesses which configuration of product and services are needed in order to integrate the solution into production lines and the business process.

Besides the sales team support, INHANCER integrates with the process team that need to understand the evolving end-users' needs and embed them into configurations throughout the project life-cycle and translate the needs into configuration-suggestions and system requirements for Level 1 QFD matrix. Similarly feedback during iterations can be given using reverse QFD process.

ADONIS is a process-based tool. Therefore, the implementation requires descriptions of processes. Basic processes that are described are

Process team:

New Product/service Development process (NPD)

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[22] https://quality-one.com/control-plan/

New Product/service Introduction process (NPI)

The used process for designing is GD3[23];

Step 1.   VISIO and INTENTIO

        Need analysis and concept creation, use strategy template

        Strategic process for need, use PSS Profiler

        Technological and process gap analysis

        Market need; Voice of Customer (VOC), used tool INHANCER

        Business Impact analysis (BIA)

        Concept creation; modelling

Step 2   STRATEGY structuring

        System structuring, use CSL

        Define Goals, OKR and KPI for initiative, use QFD

        Make feasibility and risk assessment

        Define project and resources, Use JIRA

STEP 3   CONSENSUS

        Customer feed-back, use INHANCER

        Organisation feed-back, use INHANCER, HoQ and JIRA

        Define new processes, use ADONIS

        Make test cases and verify, use ADONIS

STEP 4   OPERATIVE PLANNING AND TEST

        Select scenario and customer case, use INHANCER

        Implement and train, use all tools

        Get feed-back and make iterations

        Make business impact analysis

        Make feasibility and risk analysis

STEP 5   VALIDATE AND CERTIFICATE

        Test and validate

        Establish process and models

        Certificate (internal)

        Integrate and start learning process

STEP 6   PERFORMANCE CONTROL

        Install performance KPIs

        Establish control process, use INHANCER, JIRA and ADONIS

All the processes are defined, planned and implemented using same integrated approach.

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[23] https://www.getdigitaldata.com/gd3.aspx