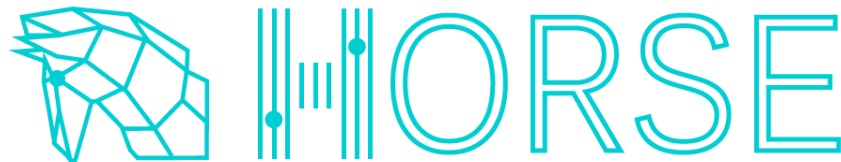# H2020 – FOF – 09 – 2015

Innovation Action

Smart integrated immersive and symbiotic human-robot collaboration system controlled by Internet of Things based dynamic manufacturing processes with emphasis on worker safety

D7.3 Guidebook for the constitution of new Competence Centres

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Editor:	B. Semolic (TCS&3L)		
Contributors:	B.Semolic & T.Sagadin (TCS&3L), A.Schmidt (TUM), J. Winters (TNO), C.Leroux, and S.Kchir (CEA), A. Garbi (ED)		
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Project website: www.horse-project.eu	

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Abbreviations

CC	Competence Centre
I4MS	ICT innovation for Manufacturing SMEs
HRI	Human-Robot-Interaction
ICT	Information and Communication Technologies
DIHs	Digital Innovation Hubs
BM	Business Model
PDO	Project Delivery Organization
CC SoW	CC Statement of Work
CC-CP	CC Charter Proposal
CC PiP	CC Project Implementation Plan
RAC Matrix	Responsibility – Authority – Communication Matrix
ISO	International Organization for Standardization

Executive Summary

This document provides a guidebook for the constitution of the new robotics Competence Centres elaborated in the HORSE project.

A Competence Centre is a facility or an entity that provides leadership, evangelization, best practices, research, support and/or training for a focus area. Competence Centres are instruments promoted by the I4MS[1] program to support the European leadership in manufacturing through the adoption of ICT technologies. HORSE project supported the creation and development of four Competence Centres dedicated to robotics in France (Paris-Saclay), Germany (Munich), the Netherlands (Delft) and Slovenia (Celje). The Competence Centres provide robotics equipment and services to facilitate the appropriation of robotics by manufacturing industries. All Competence Centres offer places to assess and enhance the capacities of the OSGi-based HORSE framework developed during the project.

Competence Centres have a regional focus and target the local actors having an interest in the deployment of ICT and more particularly robotics in manufacturing industries.

The Paris-Saclay Competence Centre at CEA in France focuses on manipulation and human-robot collaboration with no fences for an application like painting, welding, trimming, assembly and scenarios involving accurate control of the position, of the torque, applied and on the velocity control. The TUM Competence Centre in Munich concentrates on pick and place operations for various types of handling applications in a production line where human-robot cooperation with no fences is needed (co-assembly, logistics). The Competence Centre in Delft at TNO focuses on human-robot & AR solutions for manufacturing industries. The TNO CC aims at facilitating feasibility studies, demonstration, and knowledge transfer of the HORSE results to its stakeholder and in particular SMEs. The ROBOFLEX Competence Centre in Celje is a one-stop-shop for robotics for Slovenia; it is related to human-robot co-manipulation.

This document provides the guidebook with descriptions of developing steps and requirements with suggestions where to start and how build-up a new regional HORSE Competence Centre. The guidebook is based on the LENS Living Lab methodology[2] and experiences of setting-up the new HORSE Competence Centre ROBOFLEX in Slovenia.

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[1] ICT innovation for Manufacturing SMEs

[2] LENS Living Lab – INTESO Group / http://www.3-lab.eu/

1 Overview of the document

1.1 Introduction

HORSE project is focusing on fostering of advanced manufacturing technology deployment in industries and especially SMEs. The concept of I4MS *Competence Centres* (see Figure 1) is implemented in the HORSE project, with the goal to facilitate and promote the appropriation of new technologies in European industry. The HORSE model of Competence Centres (CCs) is established in four locations across Europe, to simplify usage and facilitate access to robotics by European industry and especially first-time users from SMEs. The HORSE Competence Centres are synergizing their strength from the network of regional initiatives in Slovenia, the Netherlands, Germany and France, and from the existing experience, infrastructure and capabilities of the partners. The Competence Centres are enriched during the project with the new integrated technologies that result from the HORSE framework. These functionalities will be demonstrated in the CCs in a generic way to showcase the technological possibilities offered by HORSE in order to be further adopted by other or new manufacturing players.

In line with the EC initiative to support the European leadership in manufacturing through the adoption of ICT technologies, HORSE is an **implementation of the second phase of I4MS[3]**, focusing on **Advanced Robotics** for manufacturing.
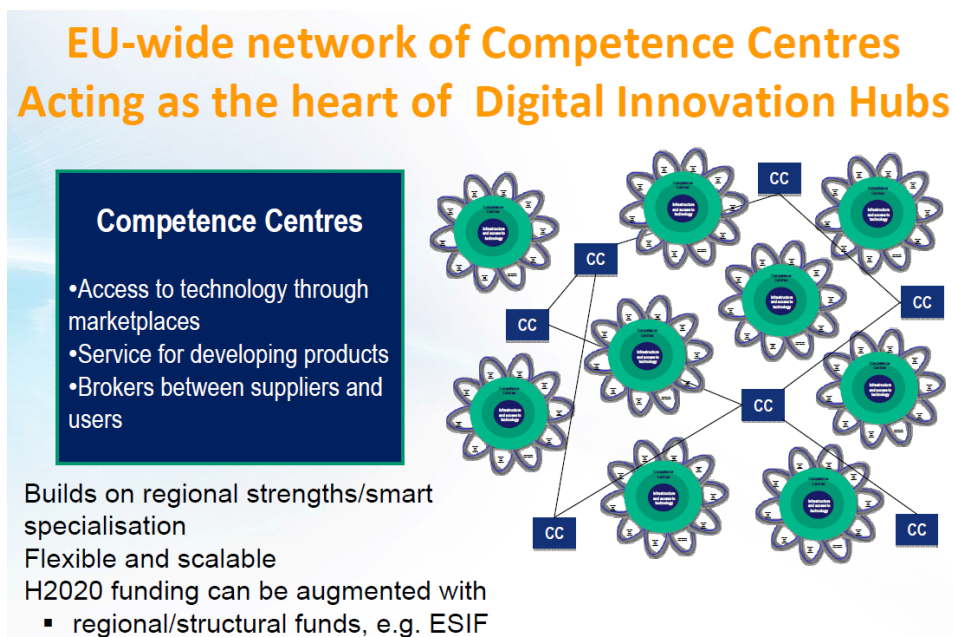

Figure 1: Competence Centres in European Union (Source: I4MS)

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[3] *"The second phase of the I4MS initiative is dedicated to share best practices and lessons learnt in the fields of Advanced robotic solutions, Simulation, Laser based applications and sensors."*

1.2 Purpose

This document (HORSE project Deliverable D7.3) is presenting the guidebook for the construction of new CCs. CCs are aiming to capture the industrial ecosystem in each region where they implemented. One of the HORSE project goals motivates the creation of a new CCs, based on the HORSE "know-how" outputs and the further development of EU network of regional CCs.

1.3 Document structure

The document is organized as follows. In the first part, which includes Chapters 2, 3 and 4 we resitute the concept of Competence Centres and their role in the HORSE project, and we describe the organization of the activity within it. The main HORSE "know-how" outputs relevant for the creation of new Competence Centres are exploited.

Chapter 5, 6 and 7 present the guidelines for potential organizers of new CCs.

1.4 Glossary

Advanced robotic solutions	Refers to a new generation of robot-based solutions in the fields of: • Reconfigurable Interactive Manufacturing Cells • Shop Floor Logistics and Manipulation • Plant inspection and servicing
Application Experiment	Application experiments provide first-time users with novel products and services and assist them to evaluate their application in their respective environments.
Assessment Experiment	Assessment Experiments support suppliers of innovative high-tech equipment to assess and validate their prototypes or products in production-like environment
Best practices	A best practice is a method or technique that has consistently shown results superior to those achieved with other means, and that is used as a benchmark. (From Wikipedia) The second phase of the I4MS initiative will be dedicated to share best practices and lessons learnt in the fields of advanced robotic solutions, Simulation, Laser-based applications and sensors.
Competence Centres	Refers to a team, a shared facility or an entity that provides leadership, evangelization, best practices, research, support and/or training for a focus area. Competence Centre are one of the HORSE instruments to facilitate the appropriation of new technologies in European industry
Competence Centres demonstration scenario	Demonstration scenarios are implementation of the use cases supported by the Competence Centres illustrating the operational capacities of the Competence Centres.
Competence Centres use cases	Use cases are generic scenarios, independent from the equipment used in the Competence Centres, illustrating the capacities offered by Competence centre for robotics applications in manufacturing industries. Use cases rely on the usage of the HORSE framework.

Factories of the Future	It is the European Public-Private Partnership (PPP) launched in 2008 which looks to engage the EU manufacturing industry and deliver the technologies needed for the new sustainable and competitive factories of the future.
I4MS initiative	ICT Innovation for Manufacturing SMEs of the European Commission launched in July 2013 targets to help SMEs and mid-caps in the manufacturing sector along three dimensions: • Provide access to Competences that can help in assessing, planning and mastering the digital transformation. • Provide access to innovation networks of a broad spectrum of Competences and best practice examples. Provide financial support to SMEs and mid-caps on the demand and the supply side to master the digital transformation.
One-stop shopping	Refers to a solution that offers a multitude of services to a client or a customer in the same location, for instance a cloud-based service. The idea is to provide convenient and efficient service and also to create the opportunity for the company to sell more products to clients and customers.
Pilot experiments	They are small-scale preliminary studies conducted in order to evaluate feasibility, time, cost, adverse events, and effect size (statistical variability) in an attempt to predict performance of a full-scale research project and suggest improvements prior to a bigger-scale test.
Client	The project owner
PDO - Project Delivery Organization	PDO is organization appointed for implementation and start-up of a new CC

2 The HORSE project "know-how" outputs

The main HORSE project goal is to motivate, foster and enable regional access to the robotics and other related Industry 4.0 digitalization technologies for the needs of manufacturing SMEs. The portfolio of different products, systems, and services related to this goal is developed and provided by the HORSE project, as follows:

- The HORSE framework
- The HORSE pilot experiments
- The HORSE application experiments
- The HORSE Competence Centres

2.1 The HORSE Framework

The HORSE framework (Figure 2) contributes to the flexibility of the production, the improvement of quality, and the enhancement of safety. Based on the OSGi middleware, it is enabling management of collaborative robotics in a manufacturing environment and rapid reconfiguration of processes. It also allows end-to-end control of productivity and efficient use of resources. The reusable framework providing access to services for end-to-end production management (ERP, MES, BPML, and PLC) will enable an easy setup of applications implying cooperation between human and robots in the same workspace.
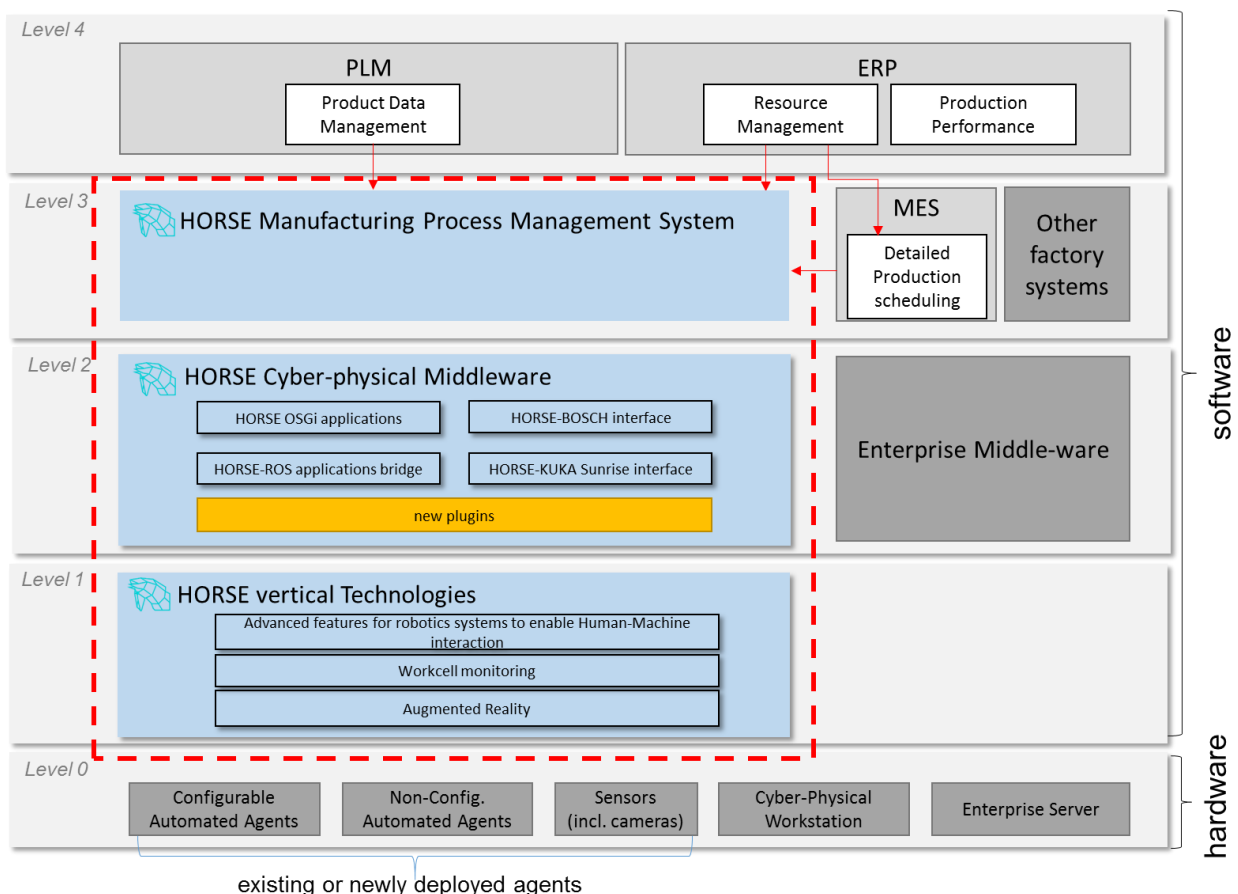

Figure 2: HORSE Framework (Source: HORSE Project)

A number of modules developed within the HORSE project implement the building blocks of the system design. These modules should be configured and customised in order to be able to realise specific scenarios of end users. These include:
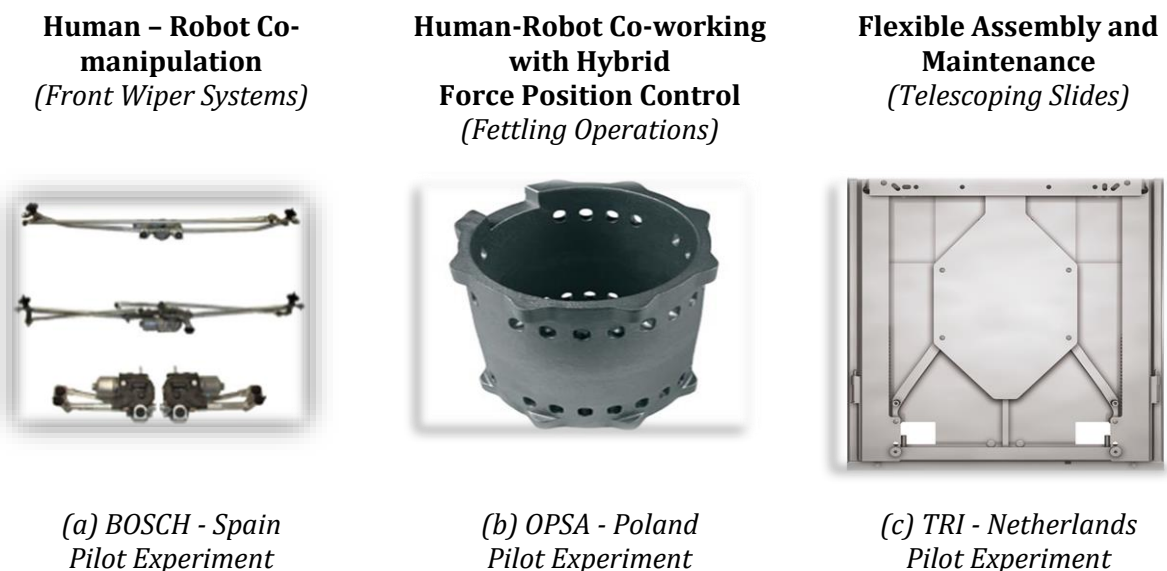
- Manufacturing Process Management System (MPMS)
- Hybrid Task Supervisor
- Middleware
- HORSE-ROS bridge
- Interface to industrial equipment: HORSE-BOSCH adapter
- Augmented Reality for assembly
- Augmented Reality for quality inspection
- Collision detection and avoidance
- Situation Awareness

2.2 The HORSE pilot and application experiments

The HORSE pilot experiments (Figure 3) present the validation of the HORSE framework in real-life settings. The HORSE pilots are three partner industries in the Netherlands, Spain, and Poland representing three different applications of robotics in manufacturing:

- Robotic-based quality (visual) inspection and human-robot co-manipulation
- Robot-human hybrid position/force control co-working applications
- Flexible assembly with mobile robot

Descriptions of the HORSE pilot experiments are also available online at the project website: http://www.horse-project.eu/Pilots

Human – Robot Co-manipulation *(Front Wiper Systems)*	**Human-Robot Co-working with Hybrid Force Position Control** *(Fettling Operations)*	**Flexible Assembly and Maintenance** *(Telescoping Slides)*
(a) BOSCH - Spain *Pilot Experiment*	*(b) OPSA - Poland* *Pilot Experiment*	*(c) TRI - Netherlands* *Pilot Experiment*

Figure 3: HORSE project pilot experiments (Source: HORSE Project)

The HORSE application experiments were selected after the open call and beneficiaries of HORSE funding. Seven experiments from the received 33 proposals was selected in order to assess the HORSE framework and to lead to:
1. better understanding of open problems for the quick adaptation of the technology,
2. further development towards a smooth integration of the technology in existing workflows and environments,
3. dissemination of the results in various application domains, countries, and communities.

The selected experiments learning outputs will be used and further transferred via the network of HORSE Competence centres.

2.3 The HORSE Competence Centres

Competence Centres in the HORSE are physical locations providing information, expertise, equipment, advice, and support services in robotic applications for manufacturing SMEs. Competence Centres offer expert advising assistance on deployment and quick assessment of robotics solutions in manufacturing.

Competence Centres are one-stop shops for manufacturing industries interested in robotics for their production line. They are places to support manufacturing SMEs to overcome the difficulties they face in adopting robotics that is:

- low awareness of the technological improvements
- low technical Competence beyond their core business
- hesitation to new long-term investment
- concerns about advanced robotic solutions, especially Human-Robot-Interaction

Competence Centres have a regional scope. They are aiming at capturing the industrial ecosystem in each region where they located.

In addition to their role in stimulating the manufacturing industries to use robotics, the Competence Centres are:

- places for implementing and upgrading the HORSE framework in settings representative of manufacturing installations,
- serve to evaluate, replicate pilot experiments in realistic industrial environments,
- be used to customize and enrich the HORSE framework for the needs of various industrial applications and requirements,
- capitalize lessons learned and best practices,
- constitute marketplaces and regional one-stop shops of robotics for manufacturing,
- be used to carry out a part of dissemination and exploitation activities.

Within the HORSE project, four pilot Competence Centres were set-up. Three existing Competence Centres were further equipped and expanded, thus exploiting existing facilities, equipment, experience and network, in France (Paris-Saclay, CEA), Germany (Munich, TUM), the Netherlands (Delft, TNO). The fourth one – CC ROBOFLEX Slovenia is established by HORSE project in Slovenia (Celje, TCS), and present the seed for the future and a model for the deployment of Competence Centres in Europe.

Figure 4: Location of HORSE Competence Centres (Source: HORSE Project)

2.4 Further guidance

Further guidance on deploying and configuring the HORSE modules, as well as on how to setup demonstrations in Competence Centres are given in other HORSE public deliverables.

Guidance, with examples, to create demonstration scenarios in Competence Centres in order to fully exploit the framework's benefits is given in the HORSE deliverable "D7.1 Competence Centre Demonstration Scenarios".

Guidance on the included modules and how they can be effectively deployed in Competence Centres is given in the HORSE deliverable "D7.2 Guidebook &recommendation for the deployment of HORSE framework for Application Experiments".

Technical guidance on deploying and configuring the HORSE Framework is given in HORSE deliverable "D4.5 User Handbook".

2.5 Sustainability and development of new Competence Centres

The lessons learned from the HORSE Pilot Experiments, the operations in the Competence Centres and the Application Experiments, are available and used to promote the experience to pave the way for further adoption by other manufacturers and SMEs in Europe.

Competence Centres are meant to be self-sustainable after the end of the project. The HORSE project demonstrated the validity of the model of Competence Centres to rapidly assess and facilitate deployment of robotics solutions for manufacturing applications by providing a set of equipment and expertise at a regional scale in Europe.

This guidebook is describing the lessons learned in the HORSE project regarding the constitution of a new Competence Centres and their efficiency to leverage industrial activity. Guidebook gives recommendations about the way how to replicate the used model of CC in other locations. The guidebook is designed to support the needs of new CC initiatives and start-ups.

3 Guidebook for the constitution of new Competence Centres

3.1 Who can be an organizer of the new HORSE Competence Centre?

Innovations and applications from the field of robotics are complex endeavours which require participation and involvement of various industry actors, in particular:

- Developers and producers of robots,
- Developers and producers of supporting technology equipment, needed for various robots' industry applications,
- System integrators in the field of robotics and automation,
- Providers and developers of specialized ICT platforms, systems, and services,
- Providers and developers of industrial engineering services, regional innovation ecosystem services, and business developers, etc.

All of those entities can initiate the development of a Competence Centre and then, once it is established, support it and participate in its activities. A critical mass of expertise is necessary to address the diverse services that the Competence Centre aims to provide, which often requires establishing partnership of several institutions. Usually, coordination of the Competence Centre activities is performed by a sub-unit of a local academic lab, research organization or cluster. Alternatively, a new legal entity formalizing the partnership between the regional partners, and representing the Competence Centre.

All listed and others who deal with this kind of innovation and development activities can be legitimate initiator and organizers of a regional Competence Centre. All Competence centres must demonstrate, professionally and marketable recognized specialization from the field of HORSE framework, with related supporting and upgrading innovation, technology transfer, and related supporting services for the needs of manufacturing SMEs.

I4MS definition of Competence Centre says:

"A compete center can be any organization (university institute, technology-research or private organization) offering technological infrastructure and accompanying skills and competencies that support the valorisation and expansion of the use of a particular I4MS technology."

In our case, the "I4MS technology" refers to the "ROBOTIC technologies designed for the needs of manufacturing SMEs."

3.2 Steps towards start-up of a new HORSE Competence Centre (CC)

Introduction

In HORSE the LENS Living Lab (3L) methodology was adopted for development and start-up of the fourth HORSE pilot Competence Centre – CC ROBOFLEX Slovenia. The 3L methodology was used for the general HORSE Competence Centre (CC) guidelines development, with the purpose to motivate and support the creation of new regional CCs and extend the existing HORSE network of Competence Centres.

Figure 5 illustrates the LENS Living Lab steps for initiation and operationalization of such new HORSE Competence Centre (CC).
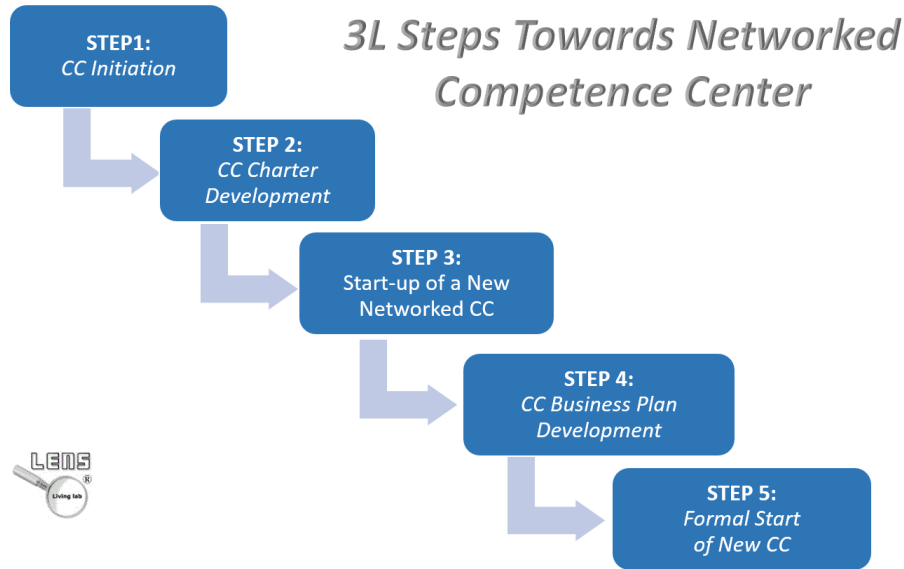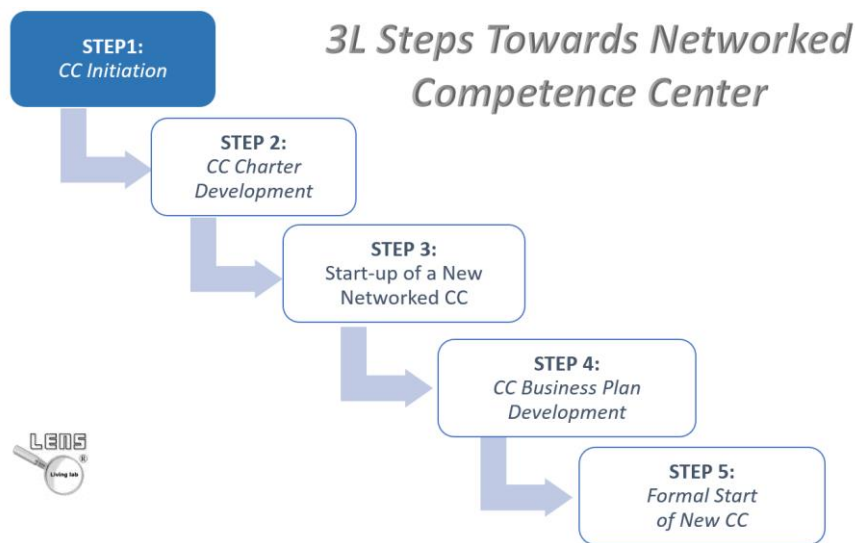
Figure 5: 3L steps for initiation and operationalization of a new HORSE Competence Centre [1]

The following sub-chapters describe the above identified steps needed in the process of constitution of a new regional networked Competence Centre. All sub-chapters are structured by standard questions, and guidelines like, what is the purpose of the observed step, points of departure - where to start, what we need to do in this step and what kind deliverable(s) is (are) expected at this point of the CC development process.

STEP 1: CC Initiation

A	**The purpose**	The purpose of this step is to formally start the process of new regional CC set up
B	**Points of Departure – where to start?**	1. HORSE framework, the list of application experiments and pilot CCs, 2. Recognized business opportunity for a new regional CC, 3. The CC initiators existing competencies, innovation potential and references from the areas of robotics, related digitalization technologies, and services for the needs of manufacturing SMEs, 4. Recognized regional manufacturing industry market needs, 5. Potential regional and international CC strategic innovation and business partners, 6. Draft CC idea
C	**What to do?**	1. Identify the CC's owner(s), 2. Define draft ***CC Project Statement of Work (CC-SoW)*** - see below task description, 3. Assign or contract the CC project manager and the core team, 4. Secure organizational and financial conditions for work 5. Communicate this CC project decision with all relevant project stakeholders
D	**Deliverable(s)**	1. Identified the CC project owner(s), 2. Defined the CC-SoW, 3. Formally empowered the CC project manager and his core team for this project, 4. Solved all organizational and financial requirements, preconditions and agreements

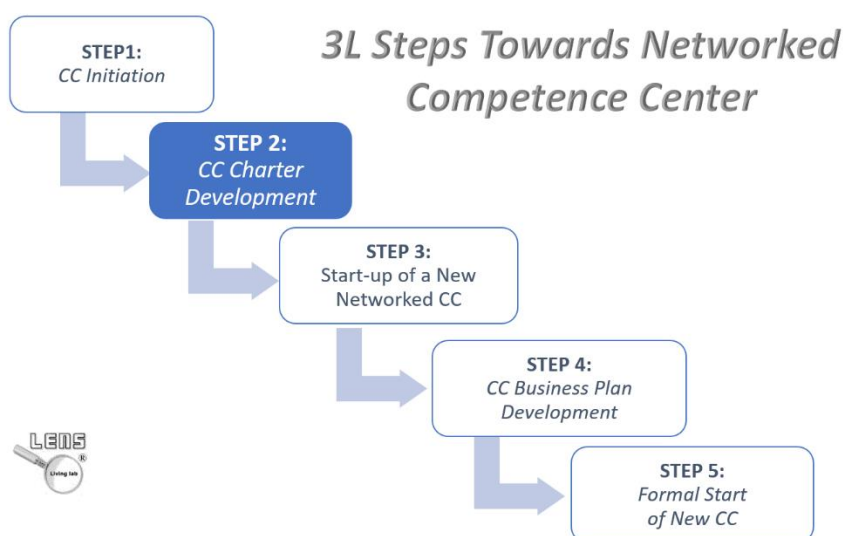**What is CC Project Statement of Work (CC-SoW)?**

CC Project Statement of Work (CC-SoW) should include the description of:

- All assigned tasks related to the STEP 2 with deliverables and the due dates,
- Available resources needed for the STEP 2,
- The governance and controlling procedures for the STEP 2,
- Costs and deadlines for payments,
- The SoW special requirements and limitations

STEP 2: CC Charter Development

A	**The purpose**	The purpose of this step is development and verification of the CC business model and the implementation project plan
B	**Points of Departure – where to start?**	1. CC project SoW (CC SoW) 2. HORSE framework, the list of application experiments and pilot CCs, 3. HORSE requirements for new CCs, 4. Information about the project owners industry research, innovation and development capabilities, with the focus on advanced robotic and related digitalization technologies, 5. Existing facilities and innovation infrastructure of CC project initiator(s), 6. Business needs and expectations of the CC initiator, 7. Business needs of the regional CC industry clients and other stakeholders, 8. The CC project owner(s) existing innovation and development strategies, 9. The list of potential project special requirements and/or limitations (content, resources, costs, finance, organization, legal, etc.)
C	**What to do?**	1. Develop the *CC Charter Proposal (CC-CP)* 2. Communicate CC-CP with the project owner(s) and relevant strategic partners, 3. CC-CP formal approval by the project owner(s)
D	**Deliverable(s)**	1. Formally approved CC-CP 2. *STEP 2 CC's project status control report*

CC Charter Proposal (CC-CP) Development

What is CC Charter?

The CC Charter describes the **CC Business Model (CC-BM)** and **CC Project Implementation Plan (CC-PiP)** of the proposed new Competence Centre in the observed region. Explains how this new CC will technology transfer, replicate and upgrade the HORSE Framework, industry cases and its network of existing HORSE Competence Centres, in the course to support regional manufacturing SMEs to overcome the difficulties they face in adopting robotics, such as:

- low awareness of the technological improvements,
- low technical Competence beyond their core business,
- hesitation to new long-term investment,
- concerns about advanced robotic solutions, especially Human-Robot-Interaction

The proposed CC business model must give clear answers about how CC services will be organized and meet the criterion of the regional "*one-stop-shop service*," for the needs regional target industry actors. The collaborative synergetic aspects with the existing or potential new regional digital innovation hubs (HUBs) must be addressed and operationalized.

What is HORSE CC Business Model?

We used the generic business model (BM) definition borrowed from the web-Business Dictionary4, as a base for development of the HORSE CC BM definition. HORSE CC BM is a description of means and methods a CC owner(s) employs to generate a value for their needs and the needs of their regional clients, and other EU region partners in its plans. It views the observed CC and its innovation ecosystem businesses as a system and answers the question, "How our CC with partners will generate a value for survival and growth?" The BM reflects the CC owners tangible and intangible views, beliefs as business reactions to the trends, HORSE project outputs, and other business innovation opportunities in the emerging digitalization markets.

HORSE CC business model is based on the theories of Triple Helix (Figure 6), open innovation, theories of virtual organizations, and inter-organizational value chains, where the holistic approach to innovation processes plays an important role (Figure 7). The simultaneous technological, organizational and behavioral innovations are critical ingredients for the new technology penetration internalization and sustainable business success in observed industry ecosystems [1] [2] [3] [4] [5].
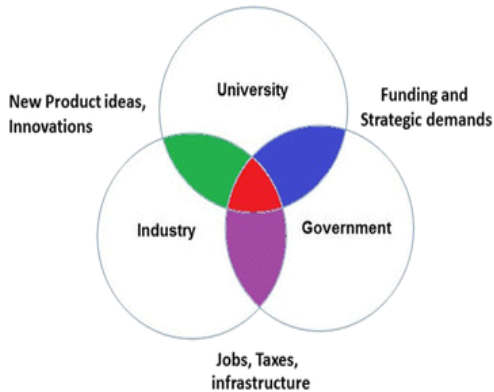
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4 http://www.businessdictionary.com/definition/business-model.html
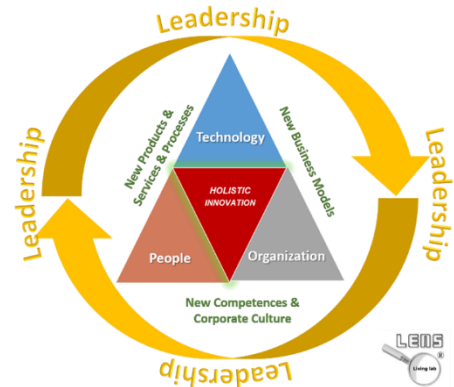
Figure 6: Concept of Triple Helix [3]

Figure 7: LENS Living Lab holistic approach to innovation [1]

LENS Living Lab definition describe **BM Charter** as a detail description of business motivators, the value proposition for observed business clients and funding organizations, list of products and services, development strategies with the description of supporting systems, resources, processes, organization, cost management system, as well as funding model, and the risks mitigation plan. Figure 8 shows the steps of CC BM Charter development [1].
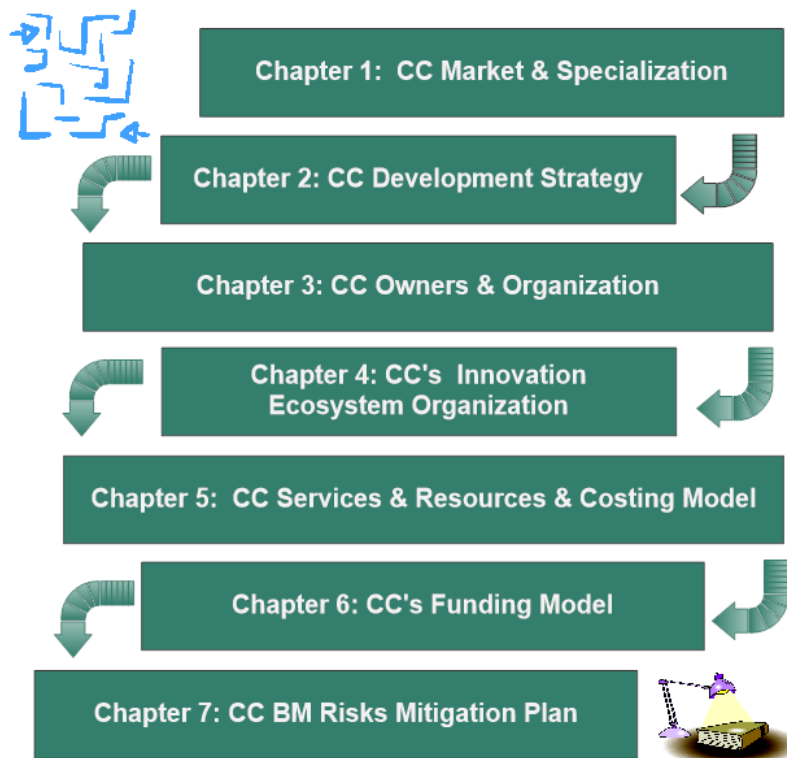

Figure 8: CC BM Charter development steps [1]

Chapter 1: CC Market(s) and Specialization:

- Identify and define the market situation, needs, trends and expectations in the observed CC' target market(s),
- Identify potential competitors and potential partners,
- Identify CC's owners and core partners,
- Identify CC's area(s) of specialization(s) and market value creation

Chapter 2: CC Development strategy (following BASE/X strategy development methodology):

- Identify CC's mission and vision,
- Define CC's global development strategy(s),
- Define CC's specialization, value chain(s) and outsourcing strategy(s),
- Define CC's industry research, technology and innovation development strategies,
- Define strategy of the CC's innovation ecosystem development,
- Define strategy of CC's operations and services
- Visualise the approach in the BASE/X strategy canvas

Chapter 3: CC Governance and Organization[5]:

- Define roles of CC's owner(s),
- Define roles and value of CC's partnering organizations,
- Define CC's organization structure and business processes,
- Define CC's RAC[6] Matrix,

Chapter 4: CC's Innovation Ecosystem Organization (see Figure 11) (depicted in BASE/X business radars methodology):

- Identify and define CC's innovation communities,
- Identify and define potential CC's strategic innovation partners,
- Define CC's open innovation collaboration platform[7] (context, organization and legal framework),
- Define e-services of platform virtual collaborative workspace.

Chapter 5: CC Services, Resources and Costing Model:

- Define CC's critical resources and services (CC's start-up phase),
- Define CC's critical resources (CC's start-up phase),
- Define CC's costing strategy,

Chapter 6: CC's Funding Model:

- Define CC's funding strategy,

Chapter 7: CC BM Risks Mitigation Plan:

- Identify BM risks (market, technical, organizational, financial, behavioral),

---

[5] The new CC can be organized and embedded within existing organizations or can be a completely new organization

[6] RAC – Responsibility, Authority, Communication

[7] Innovation Collaboration Platform – presents virtual inter-organizational open innovation collaborative working environment for work in selected areas of collaboration, supported by the appropriate organization of work and e-services (LENS Living Lab)

- Evaluate risks and
- Develop CC BM risk mitigation plan

The executive summaries of the BMs are usually presented and communicated by the use of different graphics tools, like BM Canvas, BM Radars, etc.

HORSE recommends the use of methodology **BASE/X**, which suggests service-dominant business model radar as the central tool in the **BM design step** (Figure 9). The SD business radar contains three concentric circles that correspond to the service-based value proposition, the co-production activity, and the costs or benefits for each actor. In the case of observed CC, it's business model is usually related to the business models of one or more CC's partnering organizations.
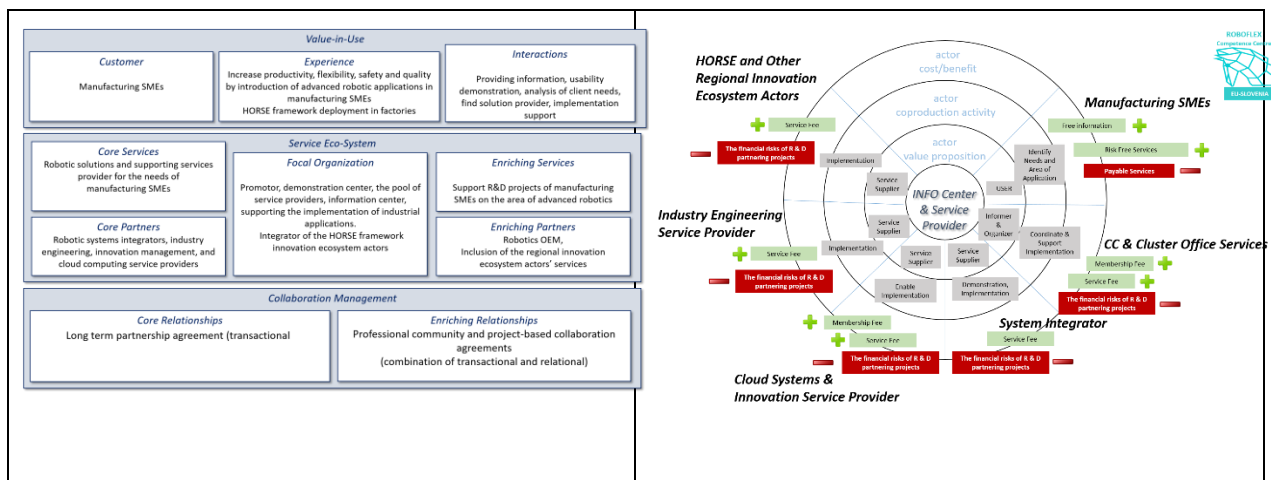

Figure 9: Example of the BASE/X strategy canvas and SD business radar

Figure 10 presents the mandatory - basic HORSE CC services [1] which need to be installed and offered by the new CC candidate if they want to be recognized as a new member of the HORSE CCs network community.
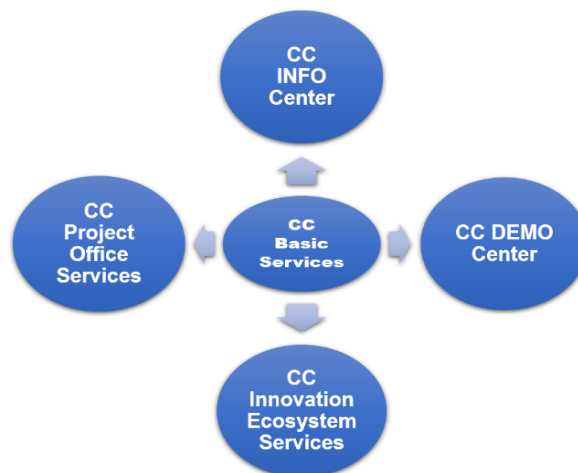

Figure 10: Mandatory – basic HORSE CC services

CC INFO Centre – is the physical and virtual place where the industry and other interested parties, from the region and abroad, can find all needed information about new robotic and supporting digitalization technologies, specializations of involved CC and its partners, related solutions and their providers. All these information must be provided by such single place ("*one-stop-shop principle*"). CC INFO Centre presents the "*entrance and access point*" to the information services provided by the regional CC with its network of HORSE partnering organizations.

CC DEMO Centre – is a facility with physical resources and services which provides "*a real-life demonstration and testing experience*" and the usability of robotic and digitalization technologies which are offered by CC and its partners. This facilities and services are designed for the needs of potential clients, users and other interested parties of these new robotic technologies and solutions.

CC Innovation Ecosystem Services – innovation ecosystem is the subset of the observed CC's business ecosystem, *where the researchers and other knowledge workers* and their organizations are operating. In question is business ecosystem sensitive, *harmonized and empowered innovation market* of balanced, well organized and synergized competencies for the innovation needs of involved business ecosystem actors [6].

HORSE CC Innovation ecosystem is organized and operated by the regional CC. CC innovation ecosystem is supported by services of the regional *open innovation collaboration platform*, organized by HORSE CC partner and its innovation and business community partners.

The CC's open innovation collaboration platform services includes:

- information about the CC's area(s) of specialization(s), *collaboration platform strategic intensions, value propositions* and the areas of *collaboration interests,*
- information about the *collaboration platform formal organization* with the *users access points and supporting services,*
- *market visibility services* of regional and international collaborative partners,
- *promotion of robotics and digitalization technologies* and services for the needs of manufacturing SMEs,
- availability of *basic collaborative workspace services for partnering initiatives and projects,* and

Figure 11 illustrates the **HORSE CC's Open Innovation Collaboration Platform**, based on the LENS Living Lab methodology for design of such open innovation system.
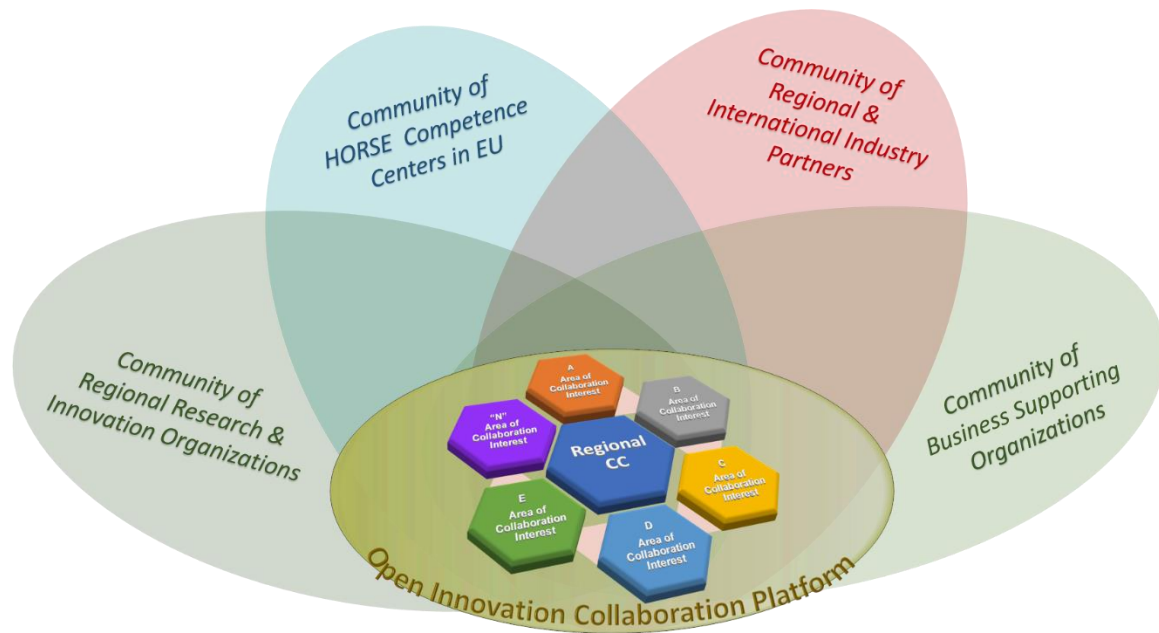
Figure 11: LENS Living Lab architecture of a HORSE CC's Open innovation Collaboration Platform [1] [4] [6] [7]

CC Project Office (PO) – is equipped by RI[8] project management experts and management consulting experts, specialized for the public open calls. Based on the LENS Living Lab methodology, CC Project Office provides the following services for the partners of CC's Open Innovation Collaboration Platform (Figure 12):

A. *information services* - about PO services and the pool of available resources, about partnering project initiatives and opportunities, about management consulting services and related offerings, about PM[9] Competences & skills and international standards,

B. *expertise services* – partnering RI project initiatives, partnering RI project business cases development, RI projects economics and funding schemes, RI project management expertise,

C. *RI project administration & reporting services* – project administration & reporting services – to support partnering RI projects in all life-cycle phases,

D. *RI project management services* – management and governance coordination of partnering RI projects,

E. *management consulting services* – helping partnering organizations and regional manufacturing SMEs to improve their performance with better exploitation of RI partnering projects, by demonstration of best practices and opportunities from the area of robotics and digitalization,

F. *RI project management training and coaching services* – list of commercial offerings and RI "real-life" project-based training services of PM knowledge transfer for the needs of regional innovation community members, their value chains, and enrich their practical experiences - skills by custom-designed coaching services.

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[8] RI – Research and Innovation

[9] PM – Project Management

Figure 12: CC Project Office Services defined by LENS Living Lab [1] [5] [7] [8]

The candidate for a new HORSE CC needs to demonstrate the presence of the <u>basic</u> PO services in this development phase of a new CC. These services are (A) information services, (C) RI project administration and reporting services, (D) RI project management services and (E) management consulting services.

We strongly recommend the use of international standard **ISO 21500** (Guidance on Project Management) in designing and performing of CC's project organization.

HORSE Requirements

New Competence Centre initiatives must meet the following HORSE requirements <u>in case</u> they want to <u>be recognized</u> as a member of the existing network of HORSE Competence Centres:

- Develop an industry-relevant demonstrator of the HORSE framework presenting its application within a manufacturing context. The demonstrator needs to involve the core elements of the <u>framework</u>: the Manufacturing Process Management System and the middleware, as well as a selection of the vertical components (<u>e.g.</u> collision detection and avoidance, situation awareness, Augmented Reality <u>etc.</u>)
- Provide the basic set of the HORSE services: access to the demonstrator, information and consulting regarding the framework, support in contacts with the developers of individual components <u>etc.</u>)
- Embed the business model of a HORSE Competence Centre, further elaborated in D 9.4 (WP 9) within the business plan of the Competence Centre.

Each of the Competence Centres acts as a gateway to the whole HORSE ecosystem, allowing the potential customers to benefits from the __complete__ wealth of the HORSE framework and its components, regardless of where and by whom they have been developed. On top of that the individual Competence Centres can provide supplementary services, e.g. integration of the HORSE-framework-based solutions, development of new components etc. Moreover, the Competence Centres may offer general services and products, which, although are not directly a part of the HORSE framework, enrich it further. Table 4-1 presents the components showcased within the demonstrators developed by the Competence Centres, the supplementary HORSE services available within each Competence Centre, as well as the enriching products and services.

- Adopt and demonstrate the use of *HORSE Framework* (Figure 2),
- develop the business model which will replicate and generate HORSE Framework, values and serve regional industry needs with partnering and support of regional, as well as of existing HORSE CC network partners,
- provide the basic CC services required by the HORSE CC business model.

Table 1 shows the list of HORSE Framework components and supporting services provided by the existing - pilot HORSE Competence Centres. The CC contact points with the addresses and e-links are provided in Table 2.

Table 1: The list of HORSE Framework products and supporting services provided by the existing pilot HORSE Competence Centres

Pilot HORSE CC	HORSE demonstr.	Supplementary HORSE Services	General CC Enreaching Services	
			Products	Services
CC CEA, Paris (F)	YES (N)	- HORSE Info Centre (N) - HORSE collaborative robots demonstration scenarios (N)	NA	- Assistance to technology transfer (P) - Demonstration, feasibility tries of robotics for manufacturing (N, P, NP) - Contacts with integrators (N) - Training of various types of robots (P) - Knowledge exchange workshops on robotics related issues (N)
CC TNO, Delft (NL)	YES (N)	- HORSE Info Centre (N) - Collaborative robot systems and Augmented Reality demonstration center (N, P, NP), - Feasibility studies and demonstrators (P)	NA	- CC innovation ecosystem collaboration platform development (P, NP), - Industry innovation scenarios and project business cases (P,NP) - Workshops on human-robot collaboration and AR (P)

CC TUM (D)	YES (N)	- HORSE Info Centre (N) - Collaborative robot systems and Augmented Reality demonstration center (N, P, NP),	NA	- Regional-level networking to integrators, technology providers, research institutions (N) - Support in financing (via external partners) (N) - Industry innovation scenarios and project business cases (P,NP)
CC ROBOFLEX (SI)	YES (N)	- HORSE Info Centre (N) - Collaborative robot systems demonstration center (N, P, NP) and Robots industry integration services (P)	- CCS ExArca (P) - Technology Collaboration Platform "Smart Machines & Systems" (NP) - KM FEST - Knowledge Management Collaboration Platform (NP)	- CC innovation ecosystem collaboration platforms development and e-services (P, NP), - Industry innovation scenarios and project business cases (P,NP) - CC Project office services (P, NP) - CC Industry networking and marketing services (N, P, NP)

Legend: **NA** – *not applied;* **N** – *not charged;* **P** – *payable;* **NP** – *not charged in cases of partnering RI projects;* **CCS ExArca** – *LENS Living Lab's cloud computing collaboration platforms service for the needs of virtual innovation communities open*

Table 2: The contact points of existing HORSE CC with the addresses and e-links

Pilot HORSE CC	Contact Persons	Address	www links
CC CEA, Paris	**Yann Perrot** Head of the Interactive Robotics Laboratory Yann.perrot@cea.fr **Pascale Betinelli** Responsible of Industrial Partnership for the robotics program Pascale.betinelli@cea.fr **Romain Farel**	**CEA SACLAY DIGITEO MOULON** Bât. 660 – Rue Noetzlin 91191 GIF-SUR-YVETTE CEDEX	http://www-list.cea.fr/en/technological-research/research-programmes/advanced-manufacturing/collaborative-robotics

	Responsible of Industrial partnership Romain.farel@cea.fr **Selma Kchir** Researcher & project manager Selma.kchir@cea.fr		
CC TNO, Delft	**Gu van Rhijn** gu.vanrhijn@tno.nl **Sam Helmer** Sam.helmer@tno.nl **Jasper Winters** Jasper.winters@tno.nl	**Robohouse** Julianalaan 67 2628 BC Delft	https://www.tno.nl/en/focus-areas/industry/roadmaps/semiconductor-equipment/smart-industry/
CC TUM, München	**Adam Schmidt** adam.schmidt@tum.de **Arne Peters** arne.peters@tum.de **Marie-Luise Neitz** neitz@in.tum.de	**Chair of Robotics, Artificial Intelligence and Real-time Systems** Schleißheimer Str. 90a 85748 Garching bei München	http://www6.in.tum.de/en/home/
CC ROBOFLEX, Celje	**Prof.Dr.Brane Semolič** CC Head & Coordinator brane.semolic@3-lab.eu **Mag.Tone Sagadin** CC Project Office & Legal Issues tone.sagadin@siol.net **Mag.Matjaž Preložnik** Coordinator of the CC DEMO Centre matjaz.preloznik@etra.si	**CC ROBOLFEX** Zavod C-TCS Kidričeva 25 3000 Celje EU-Slovenia info@toolscluster.net	https://3lexarca.com/platform/570211f1b12b68c02cadc850 http://toolscluster.net/en/

CC Project Implementation Plan

Designed CC-BM needs implementation plan. CC-BM are words, charts, and numbers on the paper and need the support of the transparent plan of its introduction into reality.
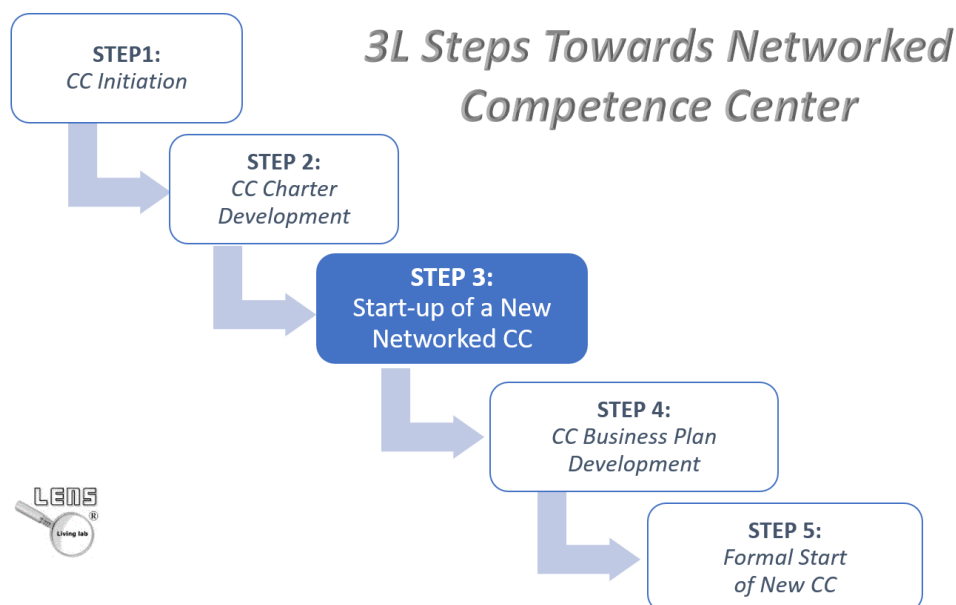
The _CC Project Implementation Plan (CC PiP)_ is a document which helps you to communicate your proposal with the project clients(s) and sponsors, how you are planning to implement the proposed business model and related solutions through the following two development steps (STEP 3 and STEP 4) of a new CC start-up.

The main components of the proposed CC PiP are:

1. Project goals and objectives,
2. Project stakeholder analysis and management plan,
3. Project scope definition,
4. Project procurement plan,
5. Project time schedule,
6. Project organization and RAC Matrix,
7. Project resource and cost plan,
8. Project finance plan,
9. Project risk management plan,
10. Project change management plan,
11. Project communication and public relations plan,
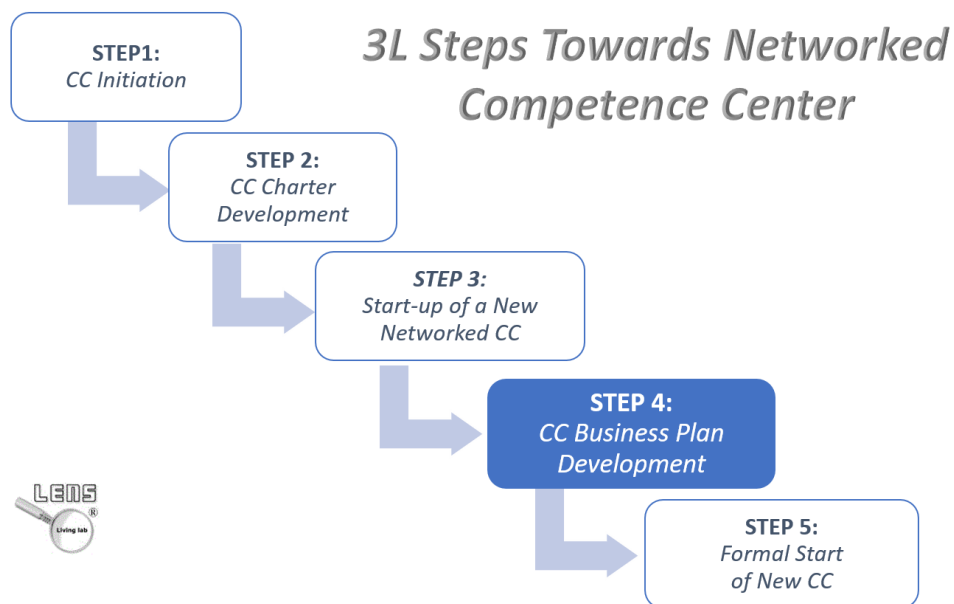12. Project quality assurance plan.

The use of international standard **ISO 21500** (Guidance on Project Management) in all phases of CC-BM implementation project is strongly recommended.
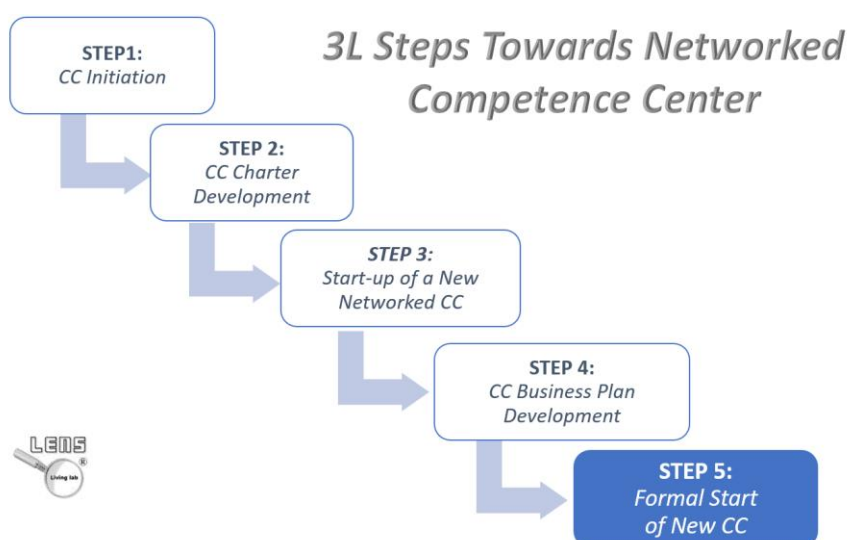
STEP 3: Start-up of the New Networked CC

A	**The purpose**	The purpose of this step is CC formal start-up and set-up of its network of regional and international partners
B	**Points of Departure – where to start?**	1. The CC Charter Proposal (CC-CP) approved by the project client organization, 2. The list of potential project client's special requirements and/or limitations

C	**What to do?**	1. Based on approved CC-BM, set-up:
		    a. The legal framework of new CC organization,
		    b. The legal network of regional and international CC's partners,
		    c. The open innovation collaboration platform,
		    d. The CC's operations and services,
		2. Initiate first CC's pilot partnering RI projects

D	**Deliverable(s)**	1. New HORSE CC formally introduced, 3. HORSE CC network of partners initiated, 4. HORSE CC operations and services available and introduced to the market, 5. First pilot CC's partnering RI projects initiated, 6. *STEP 3 - Project Control Report*

STEP 4: CC Business Plan Development

A	**The purpose**	The purpose of this step is CC Business Plan development and prepare the start of regular CC operations
B	**Points of Departure – where to start?**	1 CC's market needs and forecasts, 2 The CC Charter (CC-CP), 3 Introduced CC's operations and services, 3. Innovation potential of CC and its formalized strategic and business partners, 4. The list of potential project client's and partners special requirements and/or limitations
C	**What to do?**	1 Formal transfer all CC's project deliverables to the management of CC Operations, 2 CC Business Plan development (CC BP) – ***see HORSE template in WP 9 - project deliverable D 7.4*** 3 Communicate CC BP with CC's owners and strategic partners, 4 CC BP by the management and owners of the CC Operations 5 Prepared project close-down report for the CC's project client
D	**Deliverable(s)**	*1* Report on the takeover of project results by the CC Management, 2 Approved CC Business Plan, *3* *STEP 4 project close-down report*

STEP 5: Formal start of New CC

3L Steps Towards Networked Competence Center

A	The purpose	This step presents the formal launch of CC's operations
B	**Points of Departure – where to start?**	1 The takeover of all CC's implementation project results and deliverables, 2 Approved CC business plan, 3 CC's services and related infrastructure is operational
C	**What to do?**	1 Start managing your daily CC activities and increasing 2 Promoting a culture of continuous improvements of introduced CC operations and services, 3 The continuous search for new CC services, technologies, technology scenarios and business opportunities, 4 Develop a pool of robot-technology scenarios for manufacturing SMEs, and examples of business use cases, 5 Become an active partner and promoter of the Regional Digital Innovation Hub (DIH), 6 Promote partnering culture for manufacturing SMEs research and innovation projects, 7 Search and award best RI collaborative practices and practices from the area of robotics and related digitalization technologies, 8 Foster development of industry-driven thematic knowledge-innovation communities (KIC), 9 Develop and perform training and coaching programs for the partners from the industry and academy, for better collaboration outputs and benefits for all involved parties
D	**Deliverable(s)**	*CC - continuous operations based on the annual business plans*

4   Responsibilities

Table 5-1 presents the proposed steps towards the development of a new Competence Centre for deployment of ICT and more particularly robotics in manufacturing industries with the focus on main tasks and related responsibilities of involved organizations.

Table 3: Responsibility matrix for the start-up of a new HORSE CC

STEP	Task	Responsibilities		
		Client	PDO	CC
STEP 1	**CC Initiation**			
	CC project SoW definition (CC SoW)	X		
STEP 2	**CC Charter Development**			
	CC Charter Proposal Development (CC-CP)		X	
	CC Charter Proposal Approval	X		
STEP 3	**Start-up of a New Networked CC**			
	Realization of the approved CC Charter (CC-CP)		X	
	Approval of the STEP 3 - Project Control Report	X		
STEP 4	**CC Business Plan Development**			
	CC Business Plan Development		(X)	X
	CC Business Plan Approval	X		
	STEP 4 - Project Close-down Report		X	(X)
	Approval of the STEP 4 - Project Close-down Report	X		
STEP 5	**Formal Start of a New CC**			**X**

Legend*:*

CC – Competence Centre; PDO – Project Delivery Organization; X – Mandatory responsibility,
(X) – Must participate

The main roles in the project of a new CC development and start-up are:

- **Project Client(s)**
  The project client for a new CC project is a senior manager or a group of senior managers in case of partnering organizations, who are accountable for the corporate resources and overall performance of observed projects and expected project benefits. Project client(s) responsibilities are:
  - CC project SoW definition,
  - Ensuring CC project objectives, alignment with business needs of involved organizations and their stakeholders,
  - Selection and appointment of CC project delivery organization (PDO),
  - Approvals related to the CC Charter and other CC's contextual documents,
  - Provides needed resources for the CC project implementation,
  - Approving CC project plans, changes and status report

- o Communicate importance and strategic value of a CC project mission, and gets senor management buy-in to within involved organizations and with business partners which are relevant for the project business success,
- o Ensure overall corporate support for the observed project and resolve of project issues

- **PDO – Project Delivery Organization**
  PDO is organization appointed for implementation and start-up of a new CC. PDO can be organized in different forms. The PDO form depends on the specifics and complexity of an observed project CC business case. The PDO leaders is a project manager with the following responsibilities:
  - o Project team selection,
  - o Identify project stakeholders and their needs,
  - o Project planning, monitoring, controlling, reporting to project client(s),
  - o Management of project risks and changes,
  - o Securing resource allocation and commitments,
  - o Controlling time, resources, costs, quality, finance,
  - o Leadership of PDO members,
  - o Communicate and receive project support form project stakeholders,
  - o Communicate with client and secure all support needed for successful project performance,
  - o Transfer of all project results to management and performers of new CC operations,
  - o Provide project close-down report with the learning outputs

- **CC – Competence Centre** – *as defined in previous chapters of this report.*
  General responsibilities of an CC manager are:
  - o Monitoring and reacting on market, technology and business opportunities in the CC's business ecosystem,
  - o Planning, organizing, leading and controlling CC's daily operations,
  - o Communicate with the CC's owners and other stakeholders and receive support for CC's operational and strategic plans, programs and projects,
  - o Develop and perform CC's development and operational strategies,
  - o Securing quality services and continuous improvements of existing operations,
  - o Securing introduction of new technologies, products and services,
  - o Securing growth of CC's businesses and community of regional and international collaborative partners,
  - o Leadership of the CC innovation community partners,
  - o Permanent search and transfer best practices,
  - o Collaborate with other CCs from the HORSE network,
  - o Organize continuous learning and foster culture of knowledge organization,
  - o Award best achievements and practices,
  - o Develop and communicate CC quality standards

The main causes for this kind projects' problems are coming from the poor understanding of the CC concept; related to this, poor project goals and objectives, lack of CC project commitment, poor leadership, not an adequate acquisition of required resources and poor support from the client organization.

5 Conclusions and recommendations

This document presents the Guidebook for the constitution of new Competence Centres in the network of existing HORSE Competence Centres. That were set up in the HORSE project. Competence Centres are one of the critical elements of the I4MS program. They are central to the Digitizing Europe Initiative under discussion currently in the European Union. The Competence Centres are aiming at stimulating the industrial activity in robotics. We described the steps with guidelines on how to establish a new CC, embedded in a regional ecosystem and the network of existing HORSE Competence Centres. This guidebook is based on the LENS Living Lab methodology, used in the constitution of the fourth HORSE Competence Centre in Slovenia (CC ROBOFLEX). Guidebook also refers HORSE project used methodologies of BASE/X strategy canvas and radars methodology, as well as template for the HORSE CC's business plan development

Following the experience in HORSE it is strongly recommend the project-based approach to the creation of the new CC and the use of international standard **ISO 21500** *(Guidance on Project Management)* in all steps of development and start-up of a new CC.

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