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Abstract: Open innovation, especially in new services, places emphasis in co-creation ability for development processes. This becomes easier through digitalisation, as especially Virtual Reality technologies have been used for applications from product design to production simulation, trainings and marketing of solutions. This paper presents the background and specification of a service prototyping co-creation laboratory facility, built for testing industrial service concepts in virtual reality environments, called CoProtoLab.

Keywords: digitalisation; open innovation; servitization; virtual reality; business models

1. Servitization requires an Open innovation mindset

There has been an increasing interest in the concept of *open innovation* after a seminal book by Henry Chesbrough was published in 2006. Chesbrough argued in his book that companies and potential external innovators and supporting organisations should combine their insights into technological research into novel ideas. An open innovation process is described as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand markets for external use of innovation, respectively" (Chesbrough, 2006); in practice, a product or service development process where a multitude of different stakeholders are involved in the iterative, rapid build-and-test process. The idea of open innovation basically contains a free flow of ideas between the company and its environment, and co-creation of new products and services jointly by the company, its customers and suppliers, and the academic world. Before starting to shop for the practical technologies and applications, it is useful to co-create a concept, a tabletop prototype on how things are going to work, what they would do for the customers, and how the customers would

be paying for the product or service. The result of this "conceptual exercise" is called the business model (ibid, 63-91; Chesbrough, 2006b).

Building a business model is relatively good and simple for physical products; often a good idea of how a product works can be presented to the stakeholder evaluation already from paper-based drawings, and a multitude of 3-D design software product exist that enable even animated demonstrations of the workings and use of the product. For industrial companies, digitalisation is changing the emphasis towards an increasing proportion of *servitization*: industries using their products to sell "outcome as a service" rather than a one-off sale (Raistrick 2020). This trend, however, adds a degree of difficulty to visualising and evaluating different features in the business models.

Kohtamäki et al (2019:380) state in their aticle about the nature of servitization that "digitalization transforms the business models of solution providers and shapes their firm boundary decisions as they develop digital solutions across organizational boundaries within ecosystems such as harbors, mines, and airports." Also, servitization typically brings human beings and their actions and processes inside the "product", the offering that the customer is to evaluate before buying. According to Urbinati et al. (2018:136), the "issue is even more relevant today when innovation processes have become more open and require greater resources in the different implementation phases to capture and transfer knowledge within and outside the firm's boundaries". Some scholars and practitioners have also discussed using digital methods and tools to help illustrate the *value* delivered across servitized processes in open innovation setting (see e g Chiaroni et al., 2011; Urbinati et al., 2018). The new technologies can support the development of radical business models, innovation processes, and ecosystems, especially in turning tangible objects into intangible ones, making them more portable and simultaneously accessible for all open innovation partners (Rayna and Striukova, 2016). Digital technologies are thus also doing their part in changing innovation processes by helping stakeholder management, gaining competitive advantage, development processes, customer engagement, and data analysis (Brunswicker et al., 2015).

2. Building a VR Prototyping Laboratory for Servitization

In line of what is written above, we argue that virtual prototyping will help the development of product-service systems in the companies the same way as it helps product prototypes. In a true open innovation spirit, the Universities in Vaasa joined forces to build a digital Virtual Reality environment where visiting companies could hire in and build digital twins of their servitized processes; the rest of this article describes the features of, and first user reactions to, this CoProtoLab environment.

Conceptually, a service process can be split down in service moments. The service development also needs to accommodate the roles of different actors (customers, company, service providers, etc). Adjacent service moments can occur in parallel, but may also belong to the service offering of a different operator. Thus, the prototype should describe the time course of the service. In CoProtoLab, a service moment is illustrated as one 3D cube, each containing the service environment, users and equipment. A complete service offering then consists of several service moments and

the connections between them. New service development from scratch, of course, would even in a virtual format be a complex and expensive task. Thus, digital libraries are a useful tool that diminishes the amount of work. Libraries provide different reusable components, templates, and instructions, that can be used in the building of the complete virtual environment.

The CoProtoLab VR environment, built jointly by the universities on public funding, provides the users with the possibility to build a customizable environment to simulate service experience with different functionalities. The CoProtoLab physical space in Vaasa consists of two adjacent rooms. In the first room, the flows of the service processes are planned. It is a spacious meeting room with presentation equipment, as well as black and white boards for brainstorming. In the second room, the computers and VR equipment are located. Working with the CoProtoLab, the process of service ideation is divided into three steps, developing different conceptual levels of ideas for service development. The first step of the service ideation process is creating a concept. Here, the prerequisites for the idea generation are created with ideation tools. The organization developing its service offering can be tuned in a direction favourable to the generation of service ideas. The second step in CoProtoLab's service ideation process is idea generation. The tools at this phase can be used to generate a large number of ideas quickly; the resulting ideas are then examined, and the best of them are selected for future use. Experimenting with the ideas in Virtual Reality constitutes the third step of the CoProtoLab ideation process.

Co-creation connects the employees, customers, suppliers and other partners to develop the company's operations in an interactive and open way. Here, ideation tools can be a great resource at both the individual and organizational levels. The management of ideas often extends to a wide range of stakeholders, both inside and outside the organization. For this reason, in CoProtoLab, ideation tools and methods are arranged not only according to the different steps of the service ideation process, but also according to whether the ideation methods are to be used alone or in a group and, further, according to whether the participants come from the same organization, or whether the group also includes members from outside the organization, e.g. customers, users, suppliers or partners.

3. Servitization in Practice, in Virtual Reality

In the beginning of a customer's development session in CoProtoLab, participants join an introduction session where they are asked to explain their expectations for the service development. The facilitators of the session, both from MUOVA and the customer organisation, clarify the tasks, objectives, and the process of the workshop. Eventual contracts on the ownership of the ideas co-developed with customers and NDAs for managing the sharing of business confidential information are signed. Next, the service offering which will be prototyped is then selected — it may be an existing or general service process or service concept that is used as the starting point for development. The suitable idea generation method or methods are chosen (these ideation methods can be, for example, attribute listing, brainstorming, group methods, visualisations-moodboard, idea canvas, or SWOT analysis). The service offering concept, as a succession of process steps, is then drawn on a whiteboard, also pinpointing the goals and KPIs for the service.

The ideation is one of the main stages in the development of new services. Here, the ideation tools library for the virtual environment is used to manage/guide the process of service ideation (i.e. idea generation) by means of co-creation. Creating new capabilities for the servitizing company from will be the key to the success, growth and profitable business for their service business. In CoProtoLab, ideation is intended as a fixed function as part of service development. Idea management refers to the process by which ideas are collected and implemented effectively e.g. in prototyping. In CoProtoLab, ideation tools and methods enable this effective collection, discussion, evaluation and prioritization of ideas.

The third step, the virtual prototyping session in CoProtoLab consists of three sub-steps:

1. *Getting familiar with CoProtoLab virtual reality platform.* After the introduction session, the participants will move to another room where the moderator explains the CoProtoLab platform and how to use the virtual reality tools. The platform can be tested by the participants.

2. *Initializing the prototype.* Using the templates from the libraries, the service offering concept from the white-board will be transferred in the virtual reality. The devices, personas, and information flows are included in the virtual reality template, but can be freely changed, duplicated, and edited: library elements can be used to build systems, for example, by connecting machines to each other. The information flows will show the connections between users or devices and what kind of information is required between different stages of service. The aim of the visualisation is for companies to be able to see what corresponds to their activities best.

3. *Iterating with the prototype.* After the prototype initializing phase, users can experience and explore the service journey by "teleporting", through the use of VR lenses, between different service moments. In this phase, more advanced users will not only learn about service moments but can also continuously fine-tune them, by editing the prototype, changing, adding and removing different objects, using the virtual libraries. Other participants can observe the service journey from a screen and manually ideate and comment the development on the whiteboard. The prototype service process is then transferable as a file and can be presented to different stakeholders both for evaluation and training purposes.

4. Conclusion

The open innovation changed product development when it arrived, but it is even more profound in service development because services involve so many stakeholders. On the other hand, open innovation paradigm invites to co-creation and to use joiunt research and development infrastructure; this is one of the bearing ideas of creating CoProtoLab. Developing VR services is demanding, as they need to represent not only physical dimensions but also simulate customer experience, emotions and represent highly abstract theoretical concepts. Converting CAD models for the purpose of VR simulation is still a labour-intensive and computational demanding task with a steep learning curve. They require as photorealistic simulation

as possible in order to engage with the users; the calculating power of the Universities' equipment is better suited to this kind of activity than that of the SMEs.

The VR simulation environment of this kind offers significant advantages that can justify its costs and efforts – that are minimised by building the environment jontly. Firstly, new service solutions can be relatively realistically tested during the design and prototyping phase by various users and stakeholders, envisioning the whole process. Secondly, the information flows between service moments canbe also simulated and built into the eventual service process. As a result, the users will walk through the virtual environment, and evaluate the pros and cons of their existing services. Such virtual environment will allow also to evaluate KPIs and earning models of the firm.

With the VR environment and the libraries provided, the developed ideas can be relatively quickly tried out in practice. The experimenting can naturally also be conducted in the actual physical environment of the developed service. The experiences of the SMEs that have bought in to the Virtual Reality laboratory have all been positive.

References:

Brunswicker, S., Bertino, E. and Matei, S. (2015). Big data for open digital innovation — a research roadmap. *Big Data Research,* 2(2), 53–58

Chesbrough, H. (2006) *Open Innovation*. Harvard Business School Press, Cambridge, MA.

Chesbrough, H. (2006b) *Open Business Models.* Harvard Business School Press, Cambridge, MA.

Chiaroni, D., Chiesa, V. and Frattini, F. (2011). The open innovation journey: How firms dynamically implement the emerging innovation management paradigm. Technovation, 31(1), 34–43.

Kohtamäki, M., Pareda, V., Oghazi, P., Gebauer, H., and baines, T. (2019) Digital servitization business models in ecosystems: A theory of the firm. *Journal of Business Research,* Vol. 104, November 2019; pp 380-392.

Vandermerwe, S., and Rada, J. (1988) Servitization of Business: Adding Value by Adding Services. *European Management Journal*, Vol. 6, Issue 4, Winter 1988; pp. 314-324.

Rayna, T. and Striukova, L. (2016). From rapid prototyping to home fabrication: How 3D printing is changing business model innovation. *Technological Forecasting and Social Change,* 102, 214–224

Urbinati, A., Chiaroni, D., Chiesa, V. and Frattini, F. (2018). The role of digital technologies in open innovation processes: An exploratory multiple case study analysis. *R&D Management*, Vol. 5, Issue1, pp. 136-160.