Innovation in Public Service Design

Developing a co-creation tool for public service innovation journeys

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Abstract: Outpaced by the speed of digital innovation in the private sector, governments are looking for new approaches to public service innovation. Drawing on three complementary innovation theories – open innovation, recombinant innovation and co-creation – this paper presents a prototype that is designed to enhance the online innovation journey for public services. The main strategy explored is that of online public-service co-creation, allowing innovators to combine online and offline efforts. The outcome of this research is a prototype of an online co-creation tool. The tool is consumed via a web-portal that includes an overview of ongoing experiments, tools, labs data sets and digital building blocks. This paper contributes by presenting the requirements and lessons learned when developing a co-creation tool for innovation in public service design. While the proposed co-creation tool is expected to enhance and speed up online cocreation efforts, findings indicate that innovators from the public and private sector still need to learn how to combine online and offline co-creation efforts. The added value expected from the online tool is that it should provide an up to date oversight of digital building blocks, innovation methods and labs. Interviews with prospective users suggest that this oversight is needed to jumpstart the first step of the innovation journey. Development of a digital sandbox – a shared online experimentation environment – is considered to be an important next step for innovation in public service design.

Keywords:
Public services, co-creation, open innovation, recombinant innovation, e-government

1. Introduction

Across the globe, demands on public services are increasing at a fast pace[1]. This is in part due to the widespread availability of new technologies and higher expectations from digitally-savvy citizens. Citizens expect more ease of use and personalisation at all levels of government, as they have become accustomed to smartphoneempowered lives. New digital technologies are essential for broader service access as well as the provision of significant benefits to digital service users at a reduced cost. Under the umbrellas of egovernment and public innovation, many governments are searching for ways to use digital technologies to deliver better outcomes, such as better use of public resources, more open and trusting societies, and strengthened justice and care for the entire spectrum of citizens[1]. Usually, the kind of innovation needed in public service design is not clear from the start. For instance, better public services may demand the redesign of (cross-agency) processes/ workflows, user interfaces, data models or data sharing technologies. The drivers for innovation can also vary, ranging from a better user experience to lower operational cost for public agencies. In order to capture the entire spectrum of innovation types, we use a broad definition for public service innovation: doing something new that creates value for actors in the public domain. In most countries, governments agencies seek to innovate on their own. They are expected to have the knowledge, capabilities and resources to successfully innovate. However, many government agencies are struggling to innovate and employ new technologies for better public services. It is already challenging to really commit government agencies to collaborate for e-government. Here, 'really' means accepting transaction costs that inevitably accompany collaborations, including the extra costs if things are not going according to plan[2]. For instance, horizontal specialisation among agencies may result in 'silo's' that feel responsible for their own targets and KPI's, and give little incentives to accept transaction costs for collaboration[3]. Related, collaboration may require common systems, which may come at the costs

of systems single agencies have invested in previously[4]. Finally, e-government requires large amounts of human resources, including professionals that claim autonomy from their managers and other professionals[5, 6]. Even if we assume some basic willingness to collaborate, there are plenty challenges left. This deals with complexities of e-government in promoting accountable, effective, inclusive, transparent and trustworthy public services that deliver people-centric outcomes[7].

Recognizing these challenges in the Netherlands, the concept of Digicampus was developed and launched in July 2019. Digicampus draws on the Quadruple Helix innovation model[33] and seeks to tap into the innovation capacity of the entire Dutch society. Instead of insisting that government agencies innovate by themselves, a co-creation strategy with other government agencies, knowledge institutes and private software vendors is being explored. The focus shifts from agency specific innovation projects to cross-agency experimentation. One of the fundamental requirements for this form of co-creation is that government agencies must open up their digital building blocks for innovation experiments. There are numerous building blocks, ranging from web portals and authentication services to citizen data registries. Most of the building blocks in the Netherlands are only available to a controlled set of government agencies. Currently, cross-agency experimentation, or experimentation with researchers or software providers is uncommon and unsupported. This is especially problematic for designing public services from a human-centric or life event perspective, since these cross the boundaries of agency specific services. Examples include youth care services that require individuals to deal with several organisations, including municipalities, medical services and insurance companies. Considering the novelty of this approach, there are several knowledge gaps that need be addressed. In order to facilitate co-creation, Digicampus commissioned a research that (1) provides a theoretical foundation for co-creation, (2) reveals the key user requirements of innovators in the public domain and (3) develop a prototype for an online co-creation tool based on the previous steps. The objective of this paper is to share the lessons learned first-hand from these activities. The main research question is formulated as: *What are the main requirements for an open and online public service co-creation tool?*

This paper proceeds by presenting the research approach in Section two. Section three outlines the theoretical framework based on literature. Section four present the main requirements gathered from in-depth user interviews. Section five presents the prototype design and evaluation. Section six concludes this paper with a discussion and provides recommendations for future research.

RESEARCH PHASES	RESEARCH ACTIVITIES	RESULTS
1. Discovery	1. Problem identification	• Literature review of innovation theories • Interviews with experienced public service innovators • Descriptions of use cases (innovation journeys) and end-users (user stories)
	2. Define solution objectives	• Requirements from literature • Requirements from practice (interviews) • Use case diagrams of scenarios
2. Prototyping	3. Design and development	• First version of the prototype, multiple versions follow in phase 3 based on feedback
3. Evaluation	4. Demonstration 5. Evaluation 6. Communication	• Feedback on prototype through pre-evaluation • Feedback on prototype through workshop • Approved version of the prototype • Final report with recommendations

Table 1: Research approach

2. Research Approach

The research follows the design science research methodology presented by Peffers, Tuunanen, Rothenberger & Chatterjee[8] who suggest six research activities for designing an socio-technical artefact – in our case the co-creation tool. We performed the research activities in three phases: discovery, prototyping and evaluation.Table 1 provides an overview of the research phases, activities and results. The phases, activities and results in Table 1 are discussed next.

2.1 Phase 1 - Discovery

The main goal of the discovery phase is to formulate requirements for a co-creation tool. The discovery phase is executed in four steps: (1) a literature review, (2) semi-structured interviews, (3) descriptions of use cases and (4) synthesising the findings of the previous steps into requirements. First, we performed a literature review on innovation theories. For this exploration we confront three well known theoretical concepts from literature: 'open innovation', 'recombinant innovation' and 'co-creation' [9-11].

Second, we interviewed experienced public service innovators. Two goals were pursued: (1) gather insights on current public service innovations and (2) gather information on the flow of use cases (innovation journeys). We chose to perform semi-structured interviews since we wanted to spur a rich dialogue bursting with examples. Judgment sampling was used as the sampling strategy, allowing the researcher to "choose subjects according to their qualification to the research problem" [[12], p. 255]. The main criterium for selecting interview respondents was that they had more than 5 years' experience with public service innovation. A second criterium was that combined, the sample would cover a technical, architectural and policy making perspective on public service innovation. Eventually, five participants were selected for interviews. Table 2 provides an overview of the selected participants for the interviews.

RESPONDENT	ROLE	EXPERTISE
1	Business Consultant at a government IT development agency.	Acquisition of new business opportunities, public administration, information technologies.
2	Innovation Designer at a cross-organizational innovation platform.	Digital innovation, public administration, reinventing government.
3	Technical developer at a government innovation lab.	IT innovations within government context, social innovation.
4	Innovation Policy Advisor at a government agency.	Policy development, information technologies, cybersecurity, identification methodologies.
5	Enterprise Architect at a government agency.	Enterprise architecture, information technologies, innovation within the government, reinventing government.

Table 2: Interview respondents

PARTICIPANT	ROLE	EXPERTISE
1	Business Consultant at a government IT development agency.	Exploration of new business opportunities, public administration, information technologies.
2	Innovation Designer at a cross-organizational innovation platform.	Digital innovation, public administration, reinventing government.
3	Technical developer at a government innovation lab.	IT innovations within government context, social innovation.
4	Innovation Policy Advisor at a government agency.	Policy development, information technologies, cybersecurity, identification methodologies.
5	Academic researcher on digital government innovation.	Digital ecosystems, public service innovation, public-private service delivery.
6	Program manager focussed on public-private service delivery.	Digital innovation, public administration, information technologies.

Table 3: Evaluation workshop participants

The interviews were recorded, transcribed an validated by the respondents. Finally, the resulting qualitative data was analysed using Atlas.ti and codified using a combination of coding techniques from[13] and[14]. Third, two methods were employed to create descriptions of use cases. We used the user story approach to define the user needs and context. Subsequently, we used the use case approach to model user interactions in an exemplar cross-agency experiment derived from the interviews. Use cases describe how users interact with a system (or tools) in a set of scenarios. Discovering the interactions between the user and the system is a technique to create functional requirements. The guidelines to develop use cases were taken from the Unified Modeling Language (UML) standard[15].

Last, the findings from the literature reviews and interviews are confronted with the findings of the use cases. The confrontation leads to the formulation of requirements for the co-creation tool. The resulting requirements are written in the final sections of the paragraphs 3 and 4.

2.2 Phase 2 - Prototyping

The main goal of the prototyping phase is to develop a prototype of the co-creation tool based on the requirements gathered in the discovery phase. The user story approach and the use case approach laid the groundwork for the design of a User Experience (UX) and User Interface (UI) of the co-creation tool. The prototype was created using a UX/UI design program called Sketch. Sketch can simulate online environments offline to test the UX/UI.

2.3 Phase 3 - Evaluation

In the last phase, the prototype was evaluated with a group of six practitioners, including four that were also interview respondents in phase 1 and two new respondents (5 and 6 in Table 3). Table 3 provides an overview of the selected participants.

The two activities from Peffers et al. – demonstration and evaluation – are combined and performed in one evaluation round. The demonstration activity has the core function of solving the defined problem by using the prototype. The evaluation is the test of how well the tool fulfils its requirements in solving the problem. The evaluation was performed using an interactive artefact review session. During the evaluation session, the prototype is considered as the unit of analysis that was subjected to several real world use cases. This complies with Robson's guidelines on evaluating prototypes[16]. The basic setting of the evaluation process included a demo of the prototype from a user journey perspective, followed by a discussion between the presenter and the participants. To focus the discussion, the presenter asked semi-structured questions to the participants on the features of the prototype. This method complies with Runeson & Höst[17] who argue that semi-structured interviews can be used to discover 'how individuals qualitatively and quantitatively experience the phenomenon'. After the interactive demo of the prototype, participants were asked to fill in a short questionnaire. The questionnaire is available upon request.

3. Theoretical framework

Using the snowballing technique, we found three streams of innovation literature that fitted the Digi-campus context of co-creation. First, classic literature on open innovation is relevant, since this matches the quadruple helix innovation approach followed by Digicampus. Second, we explored the more recent concept of 'recombinant innovation'. Since recombinant innovation focusses on reusing building blocks that are developed somewhere else, this concept fits the context of public service innovation in which many technologies are developed outside government agencies. Third, we examined literature on co-creation as an innovation strategy. The three concepts are discussed next.

3.1 Open innovation

To create an effective innovation landscape, Chesbrough[18] introduces a model for open innovation. An innovation landscape is an environment of factors that surround innovation processes, either enabling or hampering progress[18]. Chesbrough[9] explains that open innovation is about innovating parties using external ideas and internal ideas as well as different internal and external paths from ideas to the market. In contrast to firm-centred innovation, open innovation is decentralized, peer based, and includes intrinsic and pro-social motives. The open innovation model should lead to lower costs of innovations, faster times to market and risk sharing[19]. A primary requirement for the open innovation model is that knowledge should flow freely in and out of the innovating parties[9]. The open innovation model promises a faster pace of disruption. An innovation landscape where knowledge flows freely in and out

cultivates technological progress. In his publications Chesbrough focusses on open innovation for the private sector, but the benefits are not secluded for application to the public sector. A better innovation landscape for the government is not only beneficial for the government itself and collaborating institutions but also civilians and societal interest groups.

3.2 Recombinant innovation

Recombinant innovation proposes the reuse of existing solution components into new applications, products and service[10, 20, 21]. Combining existing solution components, old and recent, can create new utilities that provide a new added value. A way to explain this statement is the example of Waz[20].Waze is a mobile phone app to support human car drivers. Waze notifies car drivers about traffic jams and recommends faster alternative routes. In order to so,Waze collects live driving information from other Waze users in combination with already existent traffic control data. The combination gives Waze users an accurate live view on the current traffic situations and alternatives[22, 23].Waze created this service by combining existing technologies present in GPS, social networks and data transmission between mobile phones. The recombination of these technologies led to a new innovation. The advantages of recombinant innovations are its ability to create short-cuts in technological progress through combining technologies[24]. This not only speeds up the innovation process but also enables new solutions that otherwise may be impossible. Frenken et al.[24] contrast recombinant innovation against branching innovation, which is a new technology that 'branches' from older technology.

Recombinant innovation has a similarity with Chesbrough's open innovation model. Recombinant innovation uses existing ideas of other sources, and the prerequisite for open innovation is free knowledge transfer. Acquiring existing ideas from other sources requires free knowledge transfer. Diversity from different sources of ideas is required to enable recombinant innovation[25, 26]. Diversity encompasses the issues of whether the right factors are present and how these factors are distributed in order to enable recombinant innovation. The ability of an organization to perform recombinant innovation is determined by its absorptive capacity[27]. Absorptive capacity is the organisational ability to recognize the value of new external knowledge, assimilate it, and apply it[27, 28]. Bessant & Trifilova[27] propose three routines to enhance the absorptive capacity to enable recombinant innovation. The routines are abstract-driven search, brokerage, and cyclic adaptation. First, abstract-driven search is looking for ideas on a higher level of abstraction based upon the core principles of a question or alternative solution[27]. This enables an organization to 'get out of the box' and levitate from the current perspective of a solution. An example of this is that if one travels by car to a destination and wants to travel faster is to ask how can someone travel the fastest, rather than how can someone travel the fastest by car. This enables the person to also look at other transportation means than a car. Second, brokerage is the ability to connect parties to enable fruitful interaction among the involved parties[29]. According to Bessant & Trifilova[27] there are three factors determining effective brokerage: (1) the availability of rich and varied networks to generate potential partner signals, (2) the use of abstract-driven search to recognize analogous situations and (3) the ability to engage potential recipients in exploring outside of their 'normal' search space. Third, cyclic adaptation is the usage of learning cycles during the development of a recombined idea[27]. This is the step where the recombined ideas are applied to the other context. As demonstrated by the Waze example, digital services are well suited for recombinant innovation[20, 30]. Services can also be split up into components and be reconnected to fulfil other purposes[31]. Beverungen, Lüttenberg, & Wolf[32] apply the recombinant innovation principles to services. The four basic operations of recombinant innovation are: dissociation (1), association (2), addition (3), and internal and external resources (4)[32].

1. Dissociation is using a specific component of an existing service to create a new one.
2. Association is the creation of a new service by combining previously existing services into a new field of operation.
3. Addition is adding a service of components of a service to a newly created service.
4. Internal and external resources are the use of an external source to innovate the existing service through addition or association.

Beverungen, Lüttenberg, & Wolf[32] found that consideration of these basic operations improve the innovation journey for new services.

REQUIREMENTS	THEORETICAL UNDERPINNING		
	Open innovation	Recombinant innovation	Co-creation
R1: The co-creation tool should allow a free flow of knowledge.	x		x
R2: The co-creation tool should be open for all types of users (innovation designers from the four helices) so that external knowledge and building blocks can be attracted for public service innovation.	x		x
R3: The co-creation tool should not a-priori restrict the type or number of knowledge contributions (e.g. papers, standards, software code, application programming interfaces, datasets) that are shared online.	x		
R4: The co-creation tool should provide an overview of existing/proven innovation building blocks.		x	
R5: The co-creation tool should provide a tool to search existing/proven innovation building blocks based on diverse metadata that enhances automated discovery.		x	
R6: The co-creation tool should enable the automated linkage and reuse of building blocks.		x	
R7: The co-creation tool should include an engagement platform as sandbox where innovators can design and experiment with new public services.			x

Table 4: Requirements based on the theoretical concepts

3.3 Co-creation

Co-creation is a relatively new innovation strategy and can be seen as a specific form of inter-organisational collaboration[11, 35]. In the literature, co-creation is defined as the active involvement of stakeholders (e.g. end users, investors, technology providers, regulators) to explore and create value in the innovation process[11]. The involvement of the end-users, software providers and researchers in Digicampus is an example of a quadruple helix model for cocreation[33]. Together the helices pool more resources and shape a process through which commitment for adopting collective solutions is cultivated. To follow the co-creation strategy is to address problems using instruments that allow representatives from all helices to participate in problem solving activities[34]. Co-creation demands that the helices share ideas, perform experiments with novel applications, and recombine each other's resources. Similar to open innovation, co-creation requires free knowledge flows between the helices. This is difficult and does not happen overnight since the actors in the various helices have different perspectives, interest, ways of working and knowledge positions[33]. While there is a growing body of literature on the requirements for 'offline' co-creation for large scale societal problems (e.g., energy, global warming, poverty), literature on guiding the development of tools for online co-creation is scarce[35]. According to Ramaswamy & Gouillart[35] online co-creation requires four well-aligned elements: (1) an experimental mindset, (2) a context for interactions, (3) network relations and (4) an engagement platform[35]. They propose to use online engagement platforms as 'sandboxes' where a select group of people co-create through experimentation and collective learning[35]. The concept of an engagement platform is similar to the concept of an online co-creation tool, but includes network building activities[35]. Moreover, building a network of co-creators is considered to be essential for promoting the use of the engagement platform. No network = no platform users. In order to cultivate such a network, engagement platforms must be open, up to date, attractive an transparent.

Drawing on the concepts of open innovation, recombinant innovation and co-creation, Table 4 summarizes the requirements (R) for the online co-creation tool to be used in the Digicampus context.

Our literature review resulted in seven theory driven requirements. Section four reveals additional requirements collected from prospective users of the co-creation tool.

4. Interview findings: exploring the innovation journey for public services

The main objective of the interviews was to discover the user requirements for the online co-creation tool. Since we wanted to collect additional requirements, the requirements collected from literature (section three) were not discussed or validated in the interviews. In order to collect additional requirements in a systematic manner, we asked the respondents – who are experienced innovators – to select an innovation project they know well and reflect on the barriers they have experienced throughout their innovation journey.

We also asked the respondents their ideas for removing these barriers. The identified barriers and their ideas confronted with the findings of the use cases are reformulated as requirements for the co-creation tool. Table 5 provides an overview of the barriers experienced throughout the innovation journey.

The interviews revealed three additional requirements. Requirement 10 – which focusses on the need for a digital sandbox as anexperimental platform – overlaps with requirement 7 from literature. For now, we do not integrate these two requirements.

#	Step in the innovation journey	Barrier	Solution idea/ requirement distilled from the interview
1	Orientation	No overview of public services experiments (who is working on what?) labs (what kind of facilities are available), tools (which tools can we use to develop services), data sets (which data sets are available and how do we connect to them) and building blocks (APIs, webservices, applications, standards).	R8: The co-creation tool should include an open online catalogue with an overview of running experiments, lessons learned, tools, data sets and building blocks can help to progress in the innovation journey.
2	Access	The public services 'building blocks' from the various government scattered and inaccessible for innovators outside specific agencies. This hampers the ability to fork/ recombine existing software.	R9: The co-creation tool should provide direct access to (copies/test versions) of real government building blocks for instance via GitHub/GitLab or similar code sharing platforms. The building blocks should be well documented. A 'building block' should be editable in order to be useful for experimentation
3	Experimentation	There is no shared experimentation platform for public services. Each innovator needs to configure his own integrated development environment, or use low code alternatives, leaving a fragmented innovation landscape with no collective learning.	R10: The co-creation tool should facilitate experimentation based on available and new building blocks. A test environment (digital sandbox) is needed to allow direct testing and experimentation, albeit with dummy data and application instances (stubs).

Table 5: Additional requirements from the interviews

5. Prototype design

Combined, the literature review and the interviews provide ten requirements for the co-creation tool. Based on these requirements, we developed a prototype of the co-creation tool. This section presents the prototype design in two steps (1) the architecture and (2) the UX and features.

5.1 Architecture

The prototype is organized as a web-portal that functions as a catalogue of building block, tools and labs that are developed and stored across the public sector. Instead of providing centralized access to copies of building blocks, the catalogue model provides centralized access to the original building blocks that are kept at the source organisations (decentralized architecture). Figure 1 provides an overview of the architecture. To structure the catalogue, we defined three starting positions for catalogue usage by innovators (the end users of the co-creation tool):

1. Discover: focusses on innovators that seek information that can help them to contemplate their innovation ideas. Information about current trending topics on public services, known user problems, backlog issues and unfulfilled needs, innovation calls and agendas as well as the results (lessons learned and prototypes) of previous experiments is provided for deciding whether to start with an innovation project or not.

2. Innovate: focusses on supporting innovators when kickstarting an innovation project. Here, innovators get access to potential partners, methodologies and tools that enable them to start innovation projects. For instance: information about parties willing to perform innovation experiments (e.g. innovation labs), innovation methods (e.g. design sprints), test environments for digital services and ongoing innovation projects can be necessary to perform experiments.
3. Apply: focusses on the needs of innovators that want to use specific digital building blocks for experimentation. For instance: information about the architecture of a public services, government standards, technical protocols, APIs, data registers and test environments.

5.2 UX and features

The tool's design is a web portal that discloses the required information to support the innovation journey of innovators in the public sector. Required information differs per user type and is scoped through user stories. The required information is dividedusing the previously discussed categories: discover, innovate, and apply. Discover focuses on providing information for orientation for innovators. 'Innovate' focuses on innovators who actively want to start up experimentation projects. 'Apply' focuses on providing access to existing building blocks. Combined with a specialized search-engine that allows users to search according to their needs, users are guided to the potentially relevant information. Users of the tool can contribute themselves by adding content, therefore growing the catalogue. The other features are the decentralization of storage and continuous screen scraping at the known sources of digital building blocks. Decentralized storage takes the burden away from the co-creation tool to maintain and update the previously items. The linkages to the content of involved parties are the only information that will be stored. Continuous screen scraping is helpful to collect standard information and keep it up to date, such as building blocks, brief descriptions about a specific lab, or ongoing innovation projects. Table 6 shows an overview of the previously described features compared to the requirements. Please note that we were unable to satisfy requirement 7 (from literature) and requirement 10 (from the interviews) in the prototype. It has proven to be very complex to develop a digital sandbox for the variety of building blocks for public services. We highlight this requirement for future research. Figures 2 presents a screenshot of the prototype.

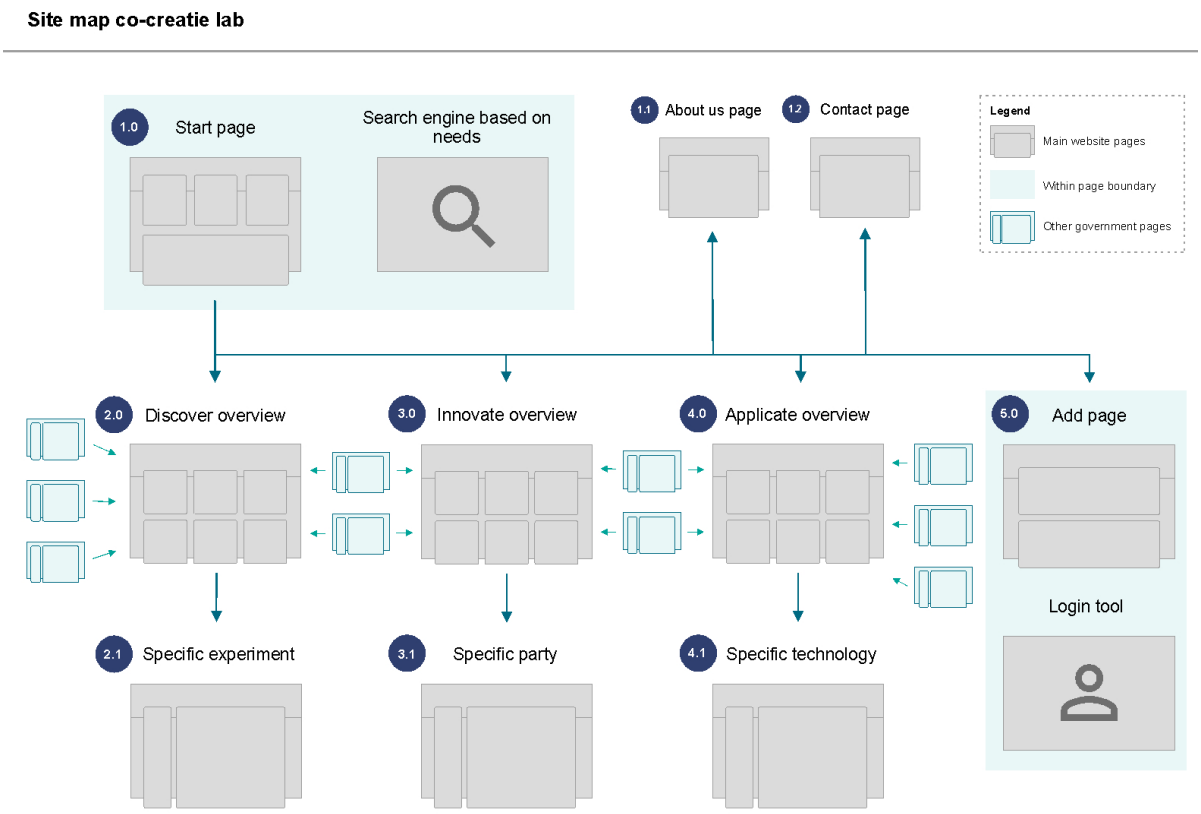

Figure 1: Architecture of the prototype catalogue

Features of the co-creation tool	Matching with requirements from literature or interview
Discover	R1, R2, R3, R5, R8
Innovate	R1, R2, R3, R8
Apply	R1, R2, R4, R6, R9
Search-engine based on needs	R1, R2, R5, R8
Add content function by user	R1, R2, R3, R6, R8
Decentralization of storage	R6, R9
Continuous screen scraping	R1, R4

Table 6: Features compared to the requirements

Questionnaire	Average score (Likert, 1 to 5 scale)
1. I find the information in this prototype useful.	4
2. I find the information in this website easy to understand.	3,2
3. Certain information I was looking for was missing on this website.	3,4
5. I consider this website user-friendly.*	3,4
6. I find the structure of this website clear.	3,6
7. It is clear which hyperlink/clickable button will lead to the information I am looking for.	3,2
8. The search option on this website gives me useful results.	3,8
9. I find the design of this website appealing.	4,2
10. Does the website look trustworthy?	4
11. Would you recommend this website to your peers?	3,8
Total average score	**3,7**

*Note: Question 4 is a qualitative question and hence not incorporated in the quantitative results table.

Table 7: Results of the quantitative questions

6. Prototype evaluation

The prototype was evaluated using an interactive session with six prospective users. The design of the session is outlined in section two. After an interactive demo of the prototype, participants were asked to fill in a short questionnaire. Table 7 outlines the average questionnaire scores provided by the participants. Overall, the prototype was found to be useful.
The evaluation results are used to create further recommendations for the implementation of the co-creation tool. The following recommendations are made to Digicampus:

- Create guidance for innovators and develop the capacity needed to set up innovation teams via the co-creation tool. The human touch is essential in guiding online co-creation.
- Develop processes that foster synergies between onlineand offline co-creation (e.g. physical meetings and design sprints).
- Improve the positioning of the co-creation tool compared to the other services of Digicampus. The online features of the co-creation tool are adjacent to the offline matchmaking and guidance services provided by Digicampus. This sparks a discussion on what the added value of the co-creation tool is for achieving the goals of Digicampus.
- Invest in a state of the art UX/UI for the co-creation tool. The current UX/UI design of the prototype is a minimum viable product. The UX/UI design needs further development before launching the co-creation tool.
- Create a roadmap for collecting and disclosing the catalogue items to innovators. This can for instance be done by stimulating the already started experiments to upload their work to the co-creation tool.
- Specify up front the quality requirements for contributions/uploaded content by innovators.
- The requirement for facilitating experimentation (R10) has not been fulfilled with this prototype. Proceed with the development of a digital sand-box that facilitates experimentation on a more technical level as add-on to the co-creation tool. Low code platforms such as Mendix and Betty Blocks can be used as inspiration for the development of a digital sandbox.

Digicampus is currently working on implementing the recommendations stated above.

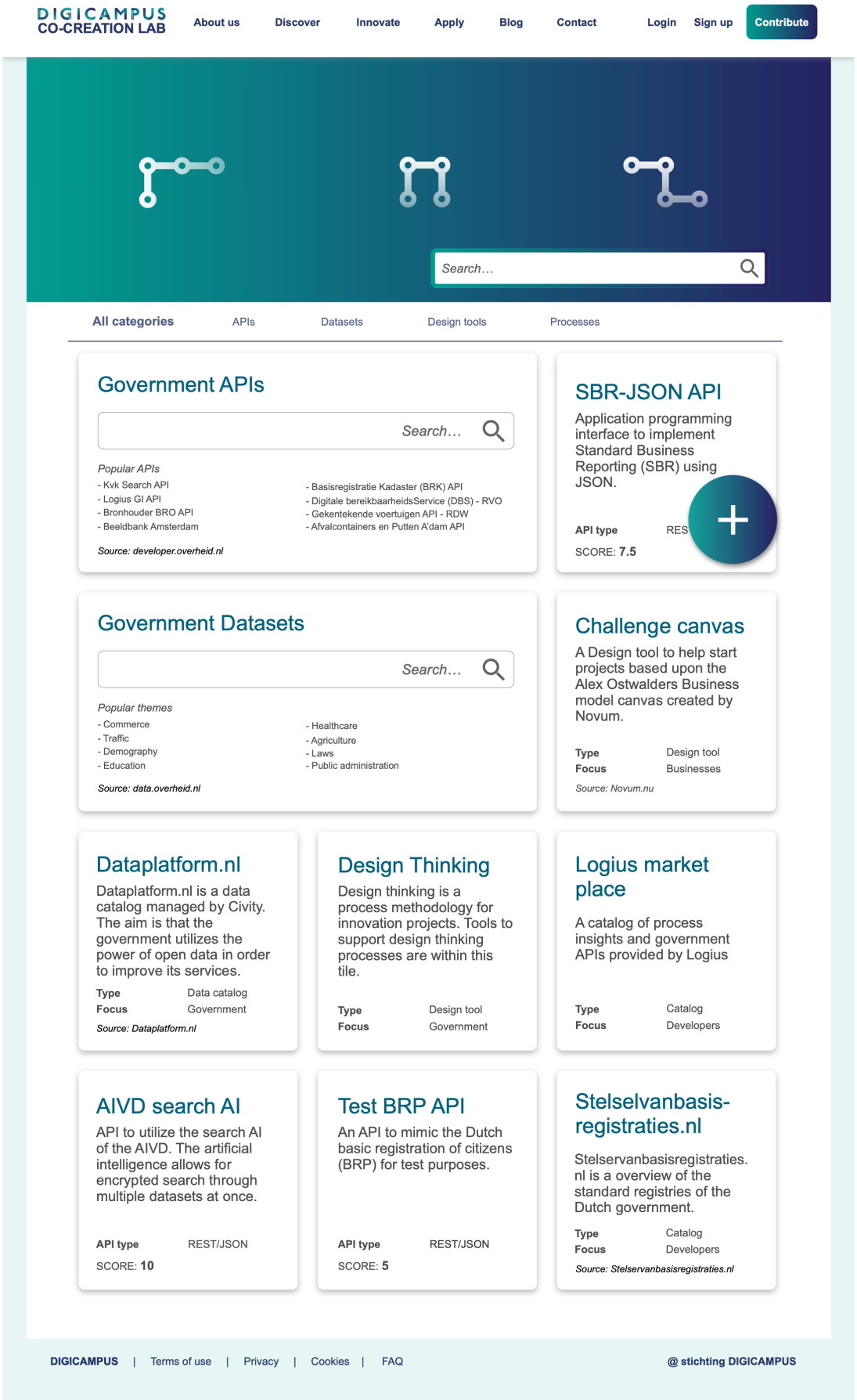

Figure 2: Screenshot of the prototype

7. Conclusions, limitations and recommendations

7.1 Conclusions

The co-creation of public services is a relatively new phenomenon. The co-creation tool presented in this paper forms a collaborative object that helps actors to learn how to co-create online. However, innovators from the public and private sector still need to learn how to effectively combine online and offline co-creation. The most important function of this tool is to provide an up to date oversight of service building blocks, innovation methods and labs. As revealed in the interviews, this oversight is one of the key enablers in the first steps of an innovation journey. The lack of a digital sandbox – i.e. and online web application development environment – is considered to be essential, yet complex to develop. The main reason for this is the lack of open and standard building blocks for public services.

7.2 Limitations

This research has two major limitations. First is the small sample of respondents used in the interviews and the prototype evaluation session. While some level of saturation can be expected when interviewing more respondents, we feel that we have not yet uncovered all requirements, guidelines and concerns for online co-creation. The second limitation is that the prototype has not yet been implemented in production, meaning that it is not yet used in Digicampus. Since there is no live version yet, we could not collect data from a broader population. Due to the COVID-19 pandemic the further development of the co-creation tool has slowed down and the first live version is expected in the third quarter of 2020.

7.3 Recommendations for further research

Putting aside the directions for future research based on the limitations of this paper, we want to highlight four new avenues for future research. First and foremost is the need for a digital sandbox – a shared online experimentation environment for configuring, deploying and testing new public services. While both literature and the interviews have highlighted the need for a digital sandbox, we were unable to satisfy this requirement in our prototype. We encourage further research on the development of a digital sandbox. A second avenue for future work lies in thoroughly examining the online innovation context in conjunction with the guidance and resource needs of users of the co-creation tool.We have not studied their online innovation context and resource needs beyond the co-creation phase, yet acknowledge that these are important factors that determine the success of innovation efforts. Third, further work can focus on mixing online and offline co-creation efforts. We expect that the online co-creation tool will promote reuse and help speed up offline activities such as design sprints since it acts as a single engagement platform. Nevertheless, we do not know which additional features are needed to support offline activities and how online and offline activities can be performed in tandem. Finally the support activities needed after successful co-creation online are still not explicitly discussed in literature. What is needed to get from successful prototypes to operational solutions for consumers of public services? How can public agencies absorb innovative solutions quickly?We anticipate that several rounds of decision making, service development and perhaps tenders (sourcing the technical components) are needed to get from innovative prototypes to operational solutions.

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REFERENCES

1. OECD, "Embracing Innovation in Government. Global Trends 2017", feb. 2017.
2. A. Cordelia, "Transaction costs and information systems: does IT add up?", J. Inf.Technol., vol. 21, nr. 3, pp. 195–202, 2006.
3. M. Janssen, H. Van Der Voort, en A. F. van Veenstra, "Failure of large transformation projects from the viewpoint of complex adaptive systems: Management principles for dealing with project dynamics", Inf. Syst. Front., vol. 17, nr. 1, pp. 15–29, 2015.
4. H. Hollenstein, "Determinants of the adoption of Information and Communication Technologies (ICT): An empirical analysis based on firm-level data for the Swiss busin ess sector", Struct. Change Econ. Dyn., vol. 15, nr. 3, pp. 315–342, 2004.
5. M. Noordegraaf, "From 'pure' to 'hybrid' professionalism: Present-day professionalism in ambiguous public domains", Adm. Soc., vol. 39, nr. 6, pp. 761–785, 2007.
6. A. Abbott, "Professional ethics", Am. J. Sociol., vol. 88, nr. 5, pp. 855–885, 1983.
7. U. Nations, United Nations E-Government Survey 2018. 2018.
8. K. Peffers, T. Tuunanen, M. A. Rothenberger, en S. Chatterjee, "A design science research methodology for information systems research", J. Manag. Inf. Syst., vol. 24, nr. 3, pp. 45–77, 2007.
9. H.W. Chesbrough, Open innovation: The new imperative for creating and profiting from technology. Harvard Business Press, 2003.
10. R. Griffith, S. Lee, en B. Straathof, "Recombinant innovation and the boundaries of the firm", Int. J. Ind. Organ., vol. 50, pp. 34–56, 2017.
11. W. H. Voorberg, V. J. Bekkers, en L. G. Tummers, "A systematic review of cocreation and co-production: Embarking on the social innovation journey", Public Manag. Rev., vol. 17, nr. 9, pp. 1333–1357, 2015.
12. U. Sekaran en R. Bougie, Research methods for business: A skill building approach. John Wiley & Sons, 2016.
13. J. M. Corbin en A. Strauss, "Grounded theory research: Procedures, canons, and evaluative criteria", Qual. Sociol., vol. 13, nr. 1, pp. 3–21, 1990.
14. J. Rowley, "Conducting research interviews", Manag. Res. Rev., vol. 35, nr. 3/4, pp. 260–271, 2012.
15. M. Fowler en C. Kobryn, UML distilled: a brief guide to the standard object modeling language. Addison-Wesley Professional, 2004.
16. C. Robson, "Real world research 2nd edition", Malden BLACKWELL Publ., 2002.
17. P. Runeson en M. Höst, "Guidelines for conducting and reporting case study research in software engineering", Empir. Softw. Eng., vol. 14, nr. 2, p. 131, 2009.
18. S. Gopalakrishnan, E. H. Kessler, en J. L. Scillitoe, "Navigating the innovation landscape: Past research, present practice, and future trends", Organ. Manag. J., vol. 7, nr. 4, pp. 262–277, 2010.
19. H. Chesbrough, Open business models: How to thrive in the new innovation landscape.Harvard Business Press, 2006.
20. E. Brynjolfsson en A. McAfee, The second machine age: Work, progress, and prosperity in a time of brilliant technologies. WW Norton & Company, 2014.
21. M. L. Weitzman, "Recombinant growth", Q. J. Econ., vol. 113, nr. 2, pp. 331–360,1998.
22. J. Spina, "Google-owned Waze aims to end traffic with new carpooling app.", okt. 11, 2018.
23. J. Bort, "Waze cofounder tells us how his company's $1 billion sale to Google really went down.", aug. 13, 2015.
24. K. Frenken, L. R. Izquierdo, en P. Zeppini, "Branching innovation, recombinant innovation, and endogenous technological transitions", Environ. Innov. Soc. Transit., vol. 4, pp. 25–35, 2012.
25. A. Stirling, "A general framework for analysing diversity in science, technology and society", J. R. Soc. Interface, vol. 4, nr. 15, pp. 707–719, 2007.
26. J. C. Van den Bergh, "Optimal diversity: increasing returns versus recombinant innovation", J. Econ. Behav. Organ., vol. 68, nr. 3–4, pp. 565–580, 2008.
27. J. Bessant en A. Trifilova, "Developing absorptive capacity for recombinant innovation", Bus. Process Manag. J., vol. 23, nr. 6, pp. 1094–1107, 2017.
28. W. M. Cohen en D. A. Levinthal, "Absorptive capacity: A new perspective on learning and innovation", Adm. Sci. Q., vol. 35, nr. 1, pp. 128–152, 1990.
29. R. S. Burt, Brokerage and closure: An introduction to social capital.Oxford university press, 2005.
30. Y. Yoo, O. Henfridsson, en K. Lyytinen, "Research commentary–the new organizing logic of digital innovation: an agenda for information systems research", Inf. Syst. Res., vol. 21, nr. 4, pp. 724–735, 2010.
31. G. Cecere en M. Ozman, "Innovation, recombination and technological proximity", J. Knowl. Econ., vol. 5, nr. 3, pp. 646–667, 2014.
32. D. Beverungen, H. Lüttenberg, en V. Wolf, "Recombinant service systems engineering", Bus. Inf. Syst. Eng., vol. 60, nr. 5, pp. 377–391, 2018.
33. E. G. Carayannis en D. F. Campbell, "'Mode 3'and'Quadruple Helix': toward a 21st century fractal innovation ecosystem", Int. J. Technol. Manag., vol. 46, nr. 3–4, pp. 201–234, 2009.
34. S. M. Lee, D. L. Olson, en S. Trimi, "Co-innovation: convergenomics, collaboration, and co-creation for organizational values", Manag. Decis., vol. 50, nr. 5, pp. 817–831, 2012.
35. V. Ramaswamy en F. J. Gouillart, The power of co-creation: Build it with them to boost growth, productivity, and profits. Simon and Schuster, 2010.