

Article

Public Value Co-Creation in Living Labs—Results from Three Case Studies

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Abstract: Living Labs—innovation units established to introduce new methods and approaches into public sector organizations—have received a lot of attention as methods for experimentation and open innovation practices in public sector organizations. However, little is known so far about how they co-create public value and which conditions influence these co-creation practices. Therefore, the research questions are: which organizational factors influence the process of public value co-creation and which outcomes and values are produced as a result? The research questions were answered by employing a qualitative research approach conducting semi-structured interviews with employees and participants of three living labs in Germany and Austria. The results show top-level support and lab leadership as the most important context factors. Living labs produce tangible and intangible outcomes. The tangible outcomes are the products developed within the lab, and the intangible outcomes are created by the interaction between the lab's participants. The main contributions are twofold: first, context factors are identified that lead to the success of co-creation processes within living labs. Second, the study contributes to the literature on public value because it is shown that participation in living labs itself leads to added value in addition to the tangible and intangible outcomes.



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1. Introduction

Living Labs are a method to enhance the innovation capabilities of public sector organizations (Schuurman and Tönurist 2017; Tönurist et al. 2017; Gascó 2017). For the purpose of this paper, living labs are defined “[. . .] as settings or environments for open innovation, which offer a collaborative platform for research, development, and experimentation in real-life contexts, based on specific methodologies and tools, and implemented through specific innovation projects and community building activities” (Gascó (2017, p. 91). This definition is suitable because it is broad enough to capture the various methods, organizational set-ups, and user groups of living labs.

Living labs are oftentimes used to reach out to internal and external stakeholders and include them in their activities (Ballon and Schuurman 2015). The set of stakeholders relevant for a lab is broad and can range from citizens, universities, corporations, and third sector organizations to civil servants (Eriksson et al. 2005; Bergvall-Kåreborn and Ståhlbröst 2009).

In the literature on living labs in the public sector, three concepts are differentiated: living labs, innovation labs, and policy labs. Schuurman and Tönurist (2017) argue that living labs need to be distinguished from innovation labs; however, this differentiation seems artificial given that innovation labs and living labs share many similarities. Both use experimentation, prototyping, and design thinking as their main methods (Eriksson et al. 2005; Følstad 2008; McGann et al. 2018). They represent a physical space and thereby provide a dedicated environment for stakeholders to meet and collaborate (Almirall and

Wareham 2011; Bloom and Faulkner 2016). Policy labs are, indeed, different from innovation and living labs because they contribute to policy development through applying design thinking (Lewis et al. 2019; Fleischer and Carstens 2021) and are exclusively located in a public sector environment.

The literature also discusses the lab's design (Stählbröst 2012), set-up (McGann et al. 2018), and organizational structure (Leminen et al. 2016). In addition, their co-creation processes are characterized by collaboration between the different participants' sharing knowledge and experiences which enables the development of innovative solutions and services (Almirall and Wareham 2011; Eriksson et al. 2005; Lehmann et al. 2015; Williamson 2015). The methods through which the co-creation process is carried out include experimentation and prototyping (Ballon and Schuurman 2015; Guzman et al. 2013; Rayna and Striukova 2019; Stählbröst 2012; Mulder 2012).

In the private sector, living labs are established as independent organizations. In contrast, in the public sector, they are sometimes created as in-house innovation units or are directly sponsored by a government agency (McGann et al. 2019; Timeus and Gascó 2018). However, the labs differ along two dimensions in their relation to government: (a) the extent of oversight that the government has over a living lab and (b) the connectedness of living labs to their parent organizations (McGann et al. 2018). For example, the Danish MindLab was part of the Ministry of Business Affairs at the time of its initiation (Carstensen and Bason 2012), but the living lab of Helsinki, SITRA, is set up as an independent organization and not as part of the city government's internal infrastructure (Tönurist et al. 2017). Due to the varying organizational set-ups, public sector living labs need to be studied independently of their private sector counterparts.

A majority of the current literature conceptualizes living labs as an innovation method with the goal to produce innovation (Følstad 2008; Tiesinga and Berkhout 2014; Timeus and Gascó 2018). Therefore, the literature on open innovation can be applied to analyze living labs as a form of collaboration among multiple stakeholders who share ideas, knowledge, and resources in these innovation processes (Gascó 2017; Leminen et al. 2012). The advantage of open innovation lies in the diversity of knowledge creation as a result of the participation of heterogeneous contributors in the open innovation processes (Mergel 2015). As a result, living labs can benefit from the collaboration with citizens and other service users, which might lead to improved outcomes of living labs.

However, it is debatable whether living labs produce innovative outcomes. For example, Leminen et al. (2015) show that the roles of a lab's participants influence to what extent a living lab is able to produce innovations. These innovations are most likely of an incremental nature because they predominantly focus on the improvement of existing products or services and not on developing radical or transformative innovations (Leminen and Westerlund 2012). Furthermore, in the public sector context, the lab itself is perceived as an innovation because it provides a space for experimentation outside the linear decision-making structure (McGann et al. 2019) or helps public managers to improve their innovation skills (Carstensen and Bason 2012).

In order to understand the impact that living labs can have, it is necessary to broaden the understanding of the outcomes they produce. To achieve this, the concept of public value is suitable. Public value has two meanings. First, it is understood as a way to capture direct and indirect effects of the interaction between a public sector organization and its environment (Moore 1995; Nabatchi 2018). Second, public values describe the individual values and normative principles that guide the activities of public sector organizations, such as accountability, responsibility, or the ethical behavior of individual public servants (Jørgensen and Bozeman 2007; Alford and O'Flynn 2009). In this study, the first meaning of public value is used to describe the outcomes that are produced through the interactions between public servants and other lab participants.

From these research gaps, two guiding research questions can be derived: (1) Which organizational factors influence the process of value co-creation within living labs, and (2) what are the outcomes and values that are produced by living labs?

To answer these research questions, 23 semi-structured interviews with participants and stakeholders of three living labs were conducted. There are two main findings. First, two main context factors can be identified that influence co-creation processes: (a) context factors internal to the lab, and (b) context factors that are external to the lab, but internal to the parent organization. External context factors include the lab's autonomy, the organizational structure of the parent organization, top-level support, and the lab's resources. The main internal factors include the lab's leadership, the mindset and motivation of the participants, and its physical space. Second, the outcomes created by the labs can be classified into two categories: intangible and tangible outcomes. Tangible outcomes include data, products, and measurable changes in digital competencies. Intangible outcomes include networks created between the lab's participants and a change in mindset among civil servants toward innovation.

There are two main theoretical contributions of this study. The first contribution is an overview of the relevant context factors that influence the co-creation processes happening in living labs. This framework might guide further research on living labs located in public sector organizations to examine the influence of these context factors on co-creation processes more systematically. The second contribution is a framework to analyze the manifold outcomes living labs produce. This framework allows future research to uncover added value that is produced through the mere participation in co-creation processes rather than through the products and services developed within living labs. Therefore, participating in living labs has beneficial effects for public servants, citizens, and other users, as well as the whole public sector organization.

In the following, the theoretical framework that guided the investigation is presented. Then, the methodology and methods used to answer the research questions are explained. Afterwards, the findings of the research are described in-depth and are discussed in light of the existing literature. The paper closes with a short conclusion including theoretical and practitioner contributions as well as the limitations of the transferability of the findings.

2. Theoretical Framework

In this section, the theoretical framework that guided the study is presented (Tummers and Karsten 2012). It consists of two parts: first, the literature on context factors that inhibit or facilitate co-creation processes is presented. Afterwards, public value theory (Moore 1995) is used to provide an overarching framework to conceptualize the lab's outcomes.

2.1. Context Factors Influencing Co-Creation Practices

The first part of the theoretical framework focuses on the environment of the living lab, which influences the co-creation processes happening within the lab. In the private sector, living labs are often designed as independent organizations, comparable to think tanks or consulting agencies, which support innovation processes by providing an environment for collaborative innovation and experimentation in a realistic environment (Ståhlbröst 2012; Gascó 2017). In the public sector, living labs are closely connected to public sector organizations. They are created as in-house units with high levels of autonomy and the freedom to experiment with otherwise not available tools and techniques. However, the interdependence between living labs and their parent organizations sets a specific context in which living labs operate. For example, Tönurist et al. (2017) show that living labs in the public sector are heavily dependent on the political support stemming from the parent organization because the support enhances the legitimacy of the living lab's operations. This ensures, in many cases, the survival of the lab itself.

Besides the political support, the lab's autonomy is an important factor in producing transformative outcomes (Tönurist et al. 2017). Timeus and Gascó (2018) provide similar evidence and note that autonomy matters for the lab to carry out its activities and tasks properly and, in turn, increases the innovative capacities of a public sector organization (see, also, Whicher and Crick 2019). Another important factor is the funding granted from the parent organization. It influences the operations of the living lab as well as its efficiency

and effectiveness (McGann et al. 2018; Timeus and Gascó 2018). Furthermore, existing research investigates how the lab itself should be designed to carry out its tasks. For example, Ståhlbröst (2012) argues that a lab needs to be open, set in a real-life environment, and empower its users. It is important that routines are established to carry out daily operations efficiently without losing the openness to employ new, user-centric methods (Bergvall-Kåreborn and Ståhlbröst 2009).

The literature on organizational factors influencing the processes within living labs is still in its infancy. The cited studies have not shown sufficient empirical evidence on how the set-up, organizational embeddedness, and other context factors contribute to the value creation efforts of living labs. As a consequence, there is additional research needed that investigates the relationship between the living lab and the public sector organization it is embedded in (Bloom and Faulkner 2016). Hence, the first research question is: Which organizational factors influence the process of value co-creation within living labs?

2.2. Outcomes Produced by Living Labs

In the living lab literature, existing research mostly focuses on the quantifiable output that a lab develops. This is not surprising, because the labs are mostly used to increase the innovation capacities of private and public sector organizations (Gascó 2017). In a systematic literature review, Hossain et al. (2019) identify three kinds of outcomes: tangible and intangible innovations, and diversity of innovation. Tangible innovations are the outputs developed by living labs such as new or improved services, products or prototypes. Intangible innovations can include the creation of new knowledge resulting from co-creation processes between stakeholders. Diversity of innovation means that living labs are able to produce different kind of innovative outcomes; they can be incremental or transformative in nature and target either individual products or services as well as societal or environmental problems (Edwards-Schachter et al. 2012).

Furthermore, the literature on living labs shows that they improve the efficiency and effectiveness of products or services (Haukipuro and Väinämö 2019). Ståhlbröst (2012) shows that living labs are capable of producing dual value. In the private sector, living labs are sometimes employed to create innovations on behalf of a company and produce value for the parent organization by providing the resources to make a firm's products more innovative. The second value is targeted toward the users who benefit from improved services because their needs were taken into account. This might then also lead to societal benefits. Examples include the improvement in quality of life, the increased sustainability of products or services, or rural development (Edwards-Schachter et al. 2012; Zavratinik et al. 2019).

What lacks this strand of literature is a theoretical framework that connects the outputs and outcomes of living labs as well as providing a sound conceptualization that allows further research to be more consistent. The concept of public value is suited to do so. In the original conceptualization, Moore (1995) shows that public value production is a core task of public managers. To accomplish this, managers act like entrepreneurs and steer governments' activities toward benefits for society at large. For example, public managers make strategic decisions to produce public value by transforming service delivery and internal processes (Bannister and Connolly 2014; Cordella and Bonina 2012).

From the public value literature (Fuglsang et al. 2021), four types of public value can be distinguished: (1) administrative values that focus on the improvement of administrative processes (Tönurist et al. 2017), (2) citizen values that aim to improve the relationships between public administrations and citizens (Bergvall-Kåreborn and Ståhlbröst 2009), (3) societal values that improve transparency, accountability and responsibility for the sake of the larger society (Dekker et al. 2019; Evans et al. 2015; Følstad 2008), and (4) economic values that improve how public administrations deliver services, save costs, and generally become more efficient and effective (Hyysalo and Hakkarainen 2014; Benington 2009). For example, citizen participation leads to public value because the decision-making process becomes more open and inclusive. The values for society consist, for example,

in accountable and transparent actions of the administration. This classification reflects earlier approaches to categorize public value (Fukumoto and Bozeman 2019; Jørgensen and Bozeman 2007), but provides a comprehensive and aggregated categorization that covers processes within the administration (economic and administrative value), as well as outside the organization (citizen and societal value).

Living labs in the public sector can serve as an environment for public value creation because they are closely connected to their parent organization and are strategically used by public managers to facilitate innovation processes (Hansen and Fuglsang 2020). In addition, they provide space for interactions between public administrations and their stakeholders, which leaves room for experimentation and unexpected results (McGann et al. 2018). Therefore, it is worthwhile to investigate which kinds of public values are produced in living labs through the interaction between public administrators and various stakeholders: for example, citizens, firms or other users of public services. The second research question is therefore: What outcomes and public values are produced by living labs?

3. Materials and Methods

In this section, the research design is explained. It contains information on the chosen methodology, the case selection strategy as well as data collection and data analysis procedures.

3.1. Methodology and Case Selection

To answer the research questions, a qualitative, interpretative approach was chosen. This approach is justified because the research questions are explorative in nature and aim to understand the dynamics and processes happening within living labs (Yin 2014). A qualitative, interpretative approach uncovers the meaning that lab participants and public servants attribute to the processes happening within the lab. These descriptions are the foundation to identify core themes in the data. Based on the themes, theoretical insights about public sector living labs are developed (Haverland and Yanow 2012).

A multiple case study approach was chosen to explore the phenomenon in depth and uncover possible explanations or causal mechanisms (Yin 2014). Each living lab counted as a single case and was, therefore, the unit of analysis (Gerring 2004). The three selected living labs are located on different government levels. The variation of the context of each living lab enabled the identification of a broad selection of factors that influence the operations of living labs as well as a number of potential outcomes they produce. This study is, therefore, not comparative, but rather offers an in-depth exploration of the different structures and mechanisms of each lab.

The cases were selected because the living lab approach in itself is a relatively new organizational form in the public sector among the German speaking countries. Therefore, they can be seen as unusual cases (Yin 2014; Curtis et al. 2000), in the sense that they are, despite their young age, influential and have managed to spark attention from the practitioner and research communities at the same time. They are highly visible and have a clear outward facing approach. The downside of selecting unusual cases is that they are non-typical cases (Seawright and Gerring 2008), which limits the generalizability of the conclusions. For example, the findings of this study might not be applicable to labs that are independent from their parent organizations or are more institutionalized. However, they are useful cases in the sense that other—future—living labs with similar context factors can learn from the insights derived from this study.

3.2. Data Collection

The sampling strategy focused on accessing the full census of all relevant interviewees both inside the labs (employees) and representatives of their main stakeholder groups. As a result, the number of interviewees varied depending on the size of the living lab. The overall number of interviews conducted is 23. All participants and stakeholders of the

living labs were interviewed. Even though the evidence base of three cases is relatively small, it represents the full sample of relevant participants at the time the data were collected.

The goal of the interviewee selection was to extract as much information as possible (Yin 2016). Therefore, interviewees such as the public servants appointed as lab leaders, other stakeholders from within the public administration, as well as the labs' users and participants were selected. The interviewees on the user side varied between the labs. In GovLab Arnsberg, the users were civil servants coming from external agencies, whereas in the Verschwörhaus the users were mainly volunteers from civil society. Through this selection strategy, a broad range of perspectives was covered and led to comprehensive insights. The overview of interviewees is shown in Table 1 below.

Table 1. Overview of the interviews conducted.

GovLab Austria	
GovLab employees	Sounding board members
Leader of GovLab Austria headquarters	Sounding board member 1
Leading board member 1	Sounding board member 2
Leading board member 2	Sounding board member 3
	Sounding board member 4
	Sounding board member 5
	Sounding board member 6
	Sounding board member 7
GovLab Arnsberg	
Govlab Arnsberg employees	External users
Head of GovLab	First GovLab participant
GovLab employee	
GovLab founder, District president	
Verschwörhaus Ulm	
Public Servants	(Digital) Volunteers
First Mayor of the City of Ulm	Volunteer 1
Head of the central services, Civil Servant 1, City of Ulm	Volunteer 2
Co-leader Verschwörhaus	Volunteer 3
Head of the Verschwörhaus, City of Ulm	Volunteer 4
Civil Servant 2, City of Ulm	

A semi-structured interview guideline was used for the data collection (Flick 2018). The questions were derived from the literature to capture the core concepts and dynamics that might be present in living labs. The questions focused on socio-demographic factors and functions of the interviewees, the work practices introduced by the living lab, as well as obstacles in the lab's processes. Another set of questions dealt with the types of users of the lab and how they participated in the lab's activities.

While most of the questions were applied to all interviewees, some were adapted to the local context and the type of interviewee. For example, the lab's participants were asked about project details in which they participated and how they were recruited. The lab's leaders were then asked about the relation of the lab to its parent organization. Hence, comparability across all cases was ensured without losing focus of local differences.

Most of the interviews were conducted by telephone in 2018 and 2019. The interviews were, with the interviewees' permission, recorded and transcribed by a transcription

service. In total, 336 pages of transcripts were collected. After each interview, the main findings were protocolled and used for data analysis.

3.3. Data Analysis

The data analysis approach consisted of three steps (Miles et al. 2014). The first step included a combination of deductive and inductive coding. During the deductive coding process, the theoretical framework was used to identify initial codes and to gain an overview of the general categories and themes identifiable in the data. By inductively coding the interview data, the theoretical framework was refined and extended. For the inductive coding step, an additional open coding approach was used. To analyze the data in-depth, process codes, descriptive codes, and in vivo codes were derived (Saldaña 2016a). Furthermore, each lab was coded separately to capture the individual dynamics and processes described by the interviewees. In a second step, the codes resulting from step one were analyzed, recoded, and categorized, looking for similarities and patterns in the codes, using pattern coding (Saldaña 2016b). In the third step, the pattern codes were analyzed and grouped in a process framework for each case. Those frameworks were then compared, looking for similarities and differences. The codes and categories are summarized in Figure 1.

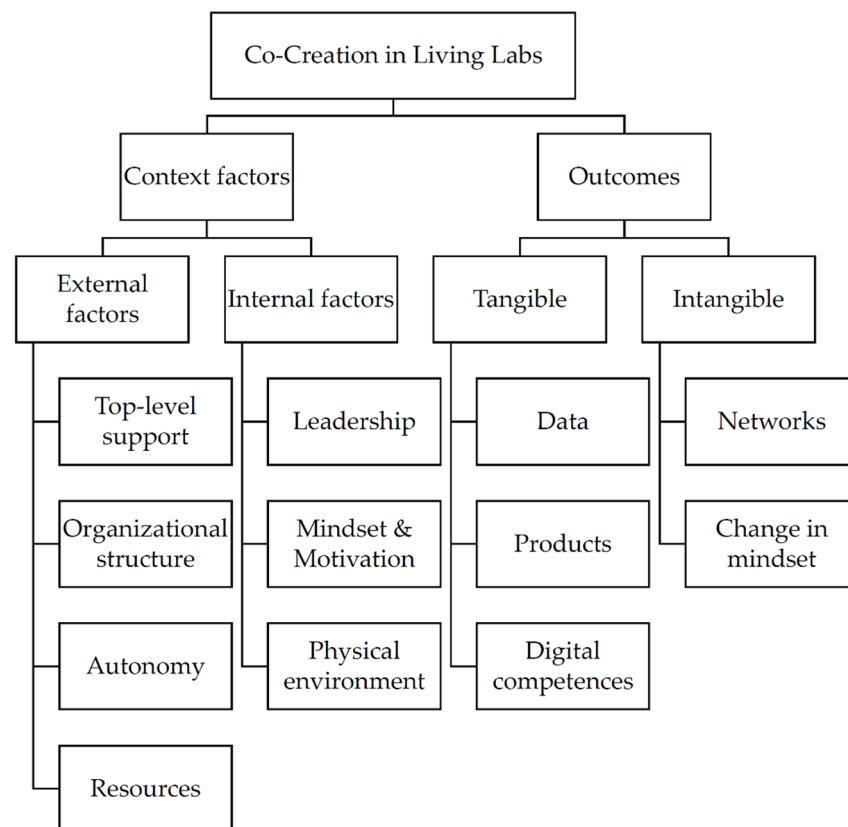


Figure 1. Summary of the coding results.

Due to the descriptive and exploratory nature of the research questions, the evidence from the interview data was treated as an account of the experiences of each individual participant, depicting how they perceived the activities in the lab. The evidence was not interpreted as definite proof of causal relations or as generalizable propositions. Results of the data analysis are displayed in the form of quotes from the interviews. Using quotes from interviews or other textual data shows what the interviewees said, which increases the transparency of the research process. This enables the reader to follow the reasoning and helps to reach conclusions. Hence, this transparency encourages scientific debate (Ospina et al. 2018).

4. Results

This section contains the main findings. First, the context factors that influence co-creation processes are explained. Context factors are identified on the level of the parent organization as well as on the level of the living lab itself. Second, the outcomes and value produced during the co-creation process are described.

Figure 1 presents a summary of the results by using the codes derived through deductive and inductive analyses of the data. On the left side, the main context factors identified are shown, divided into external and internal context factors. The right side of Figure 1 is an overview of the tangible and intangible outcomes produced by the three living labs. How the tangible and intangible outcomes are produced is described in Section 4.3.

Before the findings are described in detail, a short overview of the living labs is presented in Section 4.1. In Section 4.2, it is explained how the different context factors influence co-creation processes taking place in the living labs.

4.1. Overview of Living Labs

The three labs are located on different levels of government: GovLab Austria is part of the federal administration of Austria, in Vienna. GovLab Arnsberg is part of the regional administration in Arnsberg, North Rhine-Westphalia, and the Verschwörhaus is part of the city administration of Ulm, a major city in eastern Baden-Württemberg. Overall, the labs differ in their goals. GovLab Austria was founded in 2016 to facilitate innovation practices within the federal administration of Austria. GovLab Arnsberg and the Verschwörhaus were founded to create a space for experimentation within the administration to tackle digitalization challenges in government. For example, in GovLab Arnsberg, public servants and service users are redesigning services using design thinking methods. For the federal administration of Austria, the added value of GovLab Austria lies in the initiation of digitalization and innovation projects. GovLab Arnsberg, as well as the Verschwörhaus, are beneficial for their parent organization because the additional space for experimentation and collaboration provides the administration with flexible solutions and improved services. Table 2 provides an overview of the general characteristics of each lab analyzed in the study.

Table 2. Results from the embedded case analysis.

	GovLab Austria	GovLab Arnsberg	Verschwörhaus
Initiation	2016, by the Austrian federal government	2018, by the district government	2016, by the city administration
Goals	Innovation facilitation within the federal administration	Service redesign, creation of services, process improvement	Experimentation space with digital technologies and tools
Methods	Workshops	Design thinking, experimentation	Experimentation, prototyping
Lab participants	Public employees, third sector organizations	Public employees, service users	Citizens, public employees, volunteers
Structure	Leading board: responsible for strategic decisions Head quarter: operational tasks, responsible for organizing workshops and events Sounding board: provides feedback	GovLab leader: responsible for idea collection and moderating design thinking workshops Employee 1: assistant to GovLab leader, organization of workshops Employee 2: lab assistant, responsible for organizational matters	Two full time employees with operational tasks (organizing workshops, providing resources to volunteers)
Government level	Federal	Regional	Local
Funding	Federal government, Danube University Krems	District government	City administration

4.2. Context Factors for Public Value Co-Creation

Several factors influence the value co-creation processes on two levels: first, factors that are external to the lab but internal to the parent organization, and second, factors internal to the lab. The factors shown in Figure 1 are either present in all the labs or present in two out of the three labs. The following section offers a description of how the internal and external factors influence the activities in the living lab.

4.2.1. External Factors

Four external factors influence co-creation processes: top-level support, the lab's autonomy, the organizational structure, and the lab's resources.

The first external factor is **top-level support**. Top-level support is defined as actions by decision-makers in influential positions—usually located at the top of the organizational hierarchy—who support the activities of the living lab. Overall, top-level support can enable the planning of new services or their redesign. First, it facilitates creative thinking within the lab by giving participants the freedom to make decisions, experiment and act outside of their line tasks. For example, both in the Verschwörhaus and in GovLab Arnsberg, the support coming from the mayor and the regional president, respectively, inspired solutions that were beyond the scope of standard operation procedures usually observed in the agencies.

Second, top-level public servants backed the operations happening in the living labs. They told the lab members that they do not expect viable solutions from the lab within its first months of existence. Furthermore, they encouraged experimentation. In the Verschwörhaus, trust stemming from the mayor is reflected in the absence of formal goals of the Verschwörhaus:

“It is also very important to the mayor not to set goals in advance that have to be fulfilled [. . .] [The Verschwörhaus] does not work like that. And he knows that. It is, so to speak, that we have this freedom and we prove our work with the successes that come out of it”. (Co-lead, Verschwörhaus)

As this quote illustrates, the support of the mayor resulted in reduced pressure to deliver results with immediate value to the organization. Instead, lab members were allowed to operate independently, and subsequently defined their own goals.

Third, top-level support influences co-creation processes through providing resources such as staff, technical equipment or physical space. Those resources enabled the creation of the lab itself. The support of the mayor of the city of Ulm enabled the lab's creation, as this quote shows:

“I carry the risk [. . .] that we were able to make the contract to rent [the house], a small budget. [. . .]. I carry the risk; this is my responsibility. If it works, everyone is in. If it doesn't work, it's my fault. You have to have this kind of courage. And I believed in the leader of the Verschwörhaus, that he does his job well. [. . .] I just provided the money”. (First Mayor, City of Ulm)

Finally, top-level support increases the importance of the lab to the organization. The importance of GovLab Austria was reduced due to the lack of political support. As a result of political elections, the living lab was relocated from the chancellor's office to the Federal Ministry of Public Service and Sports:

“In this new political constellation, the GovLab Austria is unnoticed and I think the political importance has decreased a lot. This doesn't have to mean that the effectiveness is decreasing. But it certainly hasn't become easier for the GovLab Austria”. (Sounding board Member 4, GovLab Austria)

In contrast, if top-level support is high, skeptical participants tend to recognize and accept the importance of the lab for the administration and are more willing to participate in the lab's events. As a result, the co-creation processes are improved because a variety of perspectives can be integrated into the operations of the living lab. This can be mainly observed in GovLab Arnsberg.

The second factor present in all labs is lab **autonomy**. Lab autonomy is defined as the extent to which the lab members are able to make decisions independent of high-level decision makers, but also suggest new forms of operations that were not part of existing routines before. In general, different levels of lab autonomy in the three living labs can be observed. GovLab Austria exhibited relatively low levels of autonomy, which in turn slowed down the decision-making process. The creation of GovLab Austria's website illustrates this:

"My favorite example is the [GovLab Austria] homepage. It took over a year until the Gov-Lab had its own homepage and the reason is organizational structure. I had to play every square millimeter of text up and down the whole hierarchy to get it approved". (Sounding board Member 4, GovLab)

Furthermore, due to the low levels of autonomy, the original content of the ideas developed by GovLab Austria were easily changed by decision-makers, which resulted in the decreased impact of already developed ideas.

In GovLab Arnsberg, high levels of autonomy sped up the decision-making process. The regional president set up personal meetings with the head of GovLab Arnsberg. In these meetings, the regional president and the head of GovLab Arnsberg exchanged ideas on relevant projects, discussed GovLab Arnsberg's progress, and made plans on how to speed-up the decision making for projects. As a result of those meetings, the decision-making procedure and resource allocation were detached from the hierarchical decision-making processes that other departments of the regional government are subject to.

The Verschwörhaus had the highest level of autonomy: it is strategically located outside the physical space of the city's administration. Without constant direct observation, lab members were able to define and carry out their tasks without fearing interference from the mayor or other public servants, as this respondent illustrates:

"I believe it must also be said that we have approached this with a completely open mind from the very beginning. We wrote in [to the initial plan] what we wanted to do, and we do it with a sometimes brutal consequence. So, we set a goal for the Verschwörhaus and we just pursue it". (Head of Verschwörhaus)

Another result of high levels of autonomy is that it enables the creation of new ideas. The volunteers participating in the Verschwörhaus had no official goals to fulfill but independently decided on what to work on based on priorities emerging from civil society actors. This is due to the unique set-up of the living lab. Its purpose is to provide a space for digital volunteers to meet up and experiment with digital technologies. The first mayor of the city of Ulm as well as the head of the Verschwörhaus knew that this kind of engagement is valuable to the city and that imposing goals would harm the overall purpose of the living lab.

The third factor external to the lab is the **organizational structure** of the organization. What all three labs have in common is that they are connected to a bureaucratic unit that is hierarchically organized. The hierarchical structure influences the co-creation process negatively by reducing participation in the labs' activities. This is especially the case when the living lab has a tight connection to its parent organization. This dynamic is most clearly visible in GovLab Austria. Here, the hierarchies resulted in strong organizational silos that prevented the administrators from participating in the lab's activities, as this respondent from GovLab Austria describes:

"Actually, there are strong silos [in the Austrian federal government]: We have 72 sections in the whole federal administration. Those are departments that partly function like independent companies, with strong leaders, to put it charmingly. In order to

overcome this and to work together across sections on the departmental level now and not always go over the bottlenecks of the management level, is a challenge in most areas". (Leader of GovLab Austria headquarters)

Furthermore, hierarchical structures limit creative thinking because the lab participants are concerned with the implementation of those ideas in the hierarchical structure of the organization. As a result, the ideas might be less innovative. A sounding board member of GovLab Austria describes this dynamic:

"Of course, what we need to think of is, that the activities of the GovLab need to be implemented within the public administration, with different rules, as in a private sector organization or a research institute. This is reflected in our thinking about solutions and in our thought process". (Sounding board member 2, GovLab Austria)

The Verschwörhaus, in contrast, is loosely connected to the city administration of Ulm and enjoyed a high level of political support, which in turn mediated the influence of the hierarchical organizational structure on its operations. While the rest of the bureaucracy was focused on stability, the living lab pursued its goals independently.

The fourth external context factor focuses on the **lab's resources**. They are conceptualized as external to the lab because, in all cases, the resources are provided by the parent organization. There are three kinds of resources that are important: personal, technical and financial resources. A lack of staff had a negative impact on co-creation processes: the progress of individual projects was inhibited, the number of projects the living lab was able to handle simultaneously was limited, or the time when the lab is open for the public was reduced. Technical resources matter because they enable co-creation processes, especially idea generation and development. For example, the Verschwörhaus needed sophisticated technical equipment such as 3D printers, laser cutters, or woodworking tools. GovLab Arnsberg created user journeys and personas for which they needed equipment such as whiteboards or a video projector. Financial resources of the lab play an ambiguous role for co-creation processes. Both GovLab Austria and GovLab Arnsberg lacked financial resources, but the respondents did not perceive this as a barrier. Instead, the lack of financial resources pushed the lab members to find more creative solutions:

"Of course, the financing of Living Labs is an obstacle for us, but if we had the money first, because money is one obstacle, we would now have the other obstacle, namely that we find innovation projects in which people work on an equal footing and the search process for the common question. Then perhaps the development of solutions would not have been so focused". (Leading board member 2, GovLab Austria)

Nevertheless, sufficient financial resources are necessary to implement the outputs produced by living labs. For example, the Verschwörhaus needed technical equipment to implement the ideas developed by the volunteers. For GovLab Austria and GovLab Arnsberg, it is unknown if the funding provided to both labs was sufficient to implement their ideas because they were not fully implemented at the time the data were collected.

4.2.2. Internal Factors

There are three factors at the lab-level that influence co-creation processes: the leadership of the living lab, the mindset and motivation of lab participants, and the physical environment.

Leadership enables the co-creation processes within living labs in two ways: first, leaders initiate co-creation processes; second, leaders themselves facilitate co-creation. Leadership is defined as the roles and activities that are taken up by the heads of the living labs. In GovLab Arnsberg, these initiating and facilitating functions of leadership can be observed. Here, the head of the GovLab Arnsberg was responsible for collecting ideas and recruiting members from inside and outside the organization to participate in the lab's activities. Furthermore, the head of the GovLab Arnsberg moderated the design thinking workshops and facilitated the creation of new service ideas.

In the Verschwörhaus, the facilitating role of leadership was dominant. The head of the Verschwörhaus enabled the volunteers to participate in the co-creation process by providing resources, as a volunteer described:

"[The mayor] often keeps out of it as far as content is concerned. Not in the sense that he does not want to get involved, but he gives this branch a lot of freedom and acts more as the procurement office. We report to [the head of the Verschwörhaus] what we need in terms of material and we more or less design the content ourselves. There are not so many of them, this is not a plenary or something like that but I say to [a member of the Verschwörhaus] "Do we want to build this or that?" and then he says yes, ok, looks like we just need [to purchase the materials]". (Volunteer 3, Verschwörhaus)

Besides that, the head of the Verschwörhaus was responsible for communicating the activities of the Verschwörhaus to the city's public servants and mayors. By constantly communicating the activities, the head of the Verschwörhaus made sure that the lab's activities enjoyed broad support within the administration.

Mindset and motivation are individual-level characteristics. The mindset influences the development of new ideas within co-creation processes. For example, a few respondents described that they experienced employees with a risk-averse, skeptical mindset toward technology:

"In a public administration, where you have a lot of routine procedures that have been built up over a long period of time, they're of course sometimes hard to get over and if you come up with the GovLab and say "I've got some great new ideas and would like to do some things differently in public administration", then you get the whole slew of arguments as to why it's all so difficult and you've never had it before and why should you have it at all, etc". (Sounding board member 2, GovLab Austria)

The intrinsic motivation of lab members was high because in GovLab Austria as well as in the Verschwörhaus, people were involved who already knew each other. This led to increased trust between the labs' participants and less conflicts. In GovLab Austria, good interpersonal relations were important for the Sounding board members because they helped them to get started:

"[. . .] because I already knew these people [. . .] there was some kind of basic trust. I like to work with these people, I consider them inspiring personalities, I like to share ideas with them. [. . .] If I didn't know them before, it would have been more important to clarify what is our role, what is expected of us, what we can expect. But it wasn't necessary, because we already trusted each other". (Sounding board member 4, GovLab Austria)

In the Verschwörhaus, interpersonal trust led to a friendly and open atmosphere that stimulated creativity. Furthermore, the volunteers liked to visit the Verschwörhaus more often, knowing they would meet friends and like-minded acquaintances. This facilitated the co-creation processes, because the Verschwörhaus is highly dependent on time donations of its volunteers. However, the tight connection between the volunteers also raised the challenge to keep the group's structures and dynamics open to strangers visiting the Verschwörhaus the first time, as this volunteer described:

"To keep the house open, there are a lot of people from the STEM fields. As a result, the people from those areas are a closed circle [within the lab]. [. . .] And making clear, that everyone is welcome, that everyone can join, if they want to get involved, this is a big challenge that will always be a part [of the Verschwörhaus]". (Volunteer 2, Verschwörhaus)

The last factor that plays an important role in facilitating co-creation is the **physical space** of the lab, which enables creative thinking through creating a pleasant, stimulating atmosphere:

"The Verschwörhaus is relatively large, there are many rooms, many smaller rooms as well, and otherwise the interior is very casual, with many beanbags and colorful light and

quite homey I would say. Quite cozy. Exactly. Accordingly, one has fun sitting down somewhere, just chatting or unpacking the laptop [and start working]". (Volunteer 4, Verschwörhaus)

Another interviewee adds that the physical space appeared as a relaxed workspace or hobby area, instead of a formal government agency: *"It has a lot to do with the house, [. . .] it is not tidied up perfectly, it feels a bit like creativity [. . .]. The atmosphere is creative, a bit chaotic but stimulating. You do not sit in a rectangular room with grey walls". (Volunteer 2, Verschwörhaus)*. Similar dynamics were observed at GovLab Arnsberg, which is equipped with colorful and casual Ikea furniture instead of the traditional professional-looking furniture that can usually be found in public administrations.

4.3. Outcomes and Values Created by Living Labs

Living labs produce two kinds of outcomes: tangible and intangible outcomes (see Table 3). Tangible outcomes are quantifiable: for example, the data produced by sensors on the circuit board. Intangible outcomes are outcomes that are hard to measure because they are not quantifiable: for example, a change in mindset (Hossain et al. 2019).

Table 3. Types of public value co-produced in living labs.

		Type of Value			
		Economic	Administrative	Citizen	Societal
Tangible outcomes	Products and data	Products, data lead to improved services	Products, data lead to improved decision-making and service evaluation	Citizens can experiment directly with the products and data themselves	—
	Competencies	—	Public employees gain competences	Citizens gain technological competencies	—
Intangible outcomes	Networks	—	Networks facilitate the reduction of red tape	—	—
	Change in mindset	—	New work routines are established	—	Long-term transformation of relationship with society

4.3.1. Tangible Outcomes

The first outcome includes products developed by the living labs. In the Verschwörhaus, the product was a circuit board that simplified data collection by sensors. In the GovLab Arnsberg, it was a chatbot that helped users to navigate the website of the regional government. These products and services created value for users of administrative processes and for citizens who used the improved services.

The second tangible outcome is data produced by the products and services developed in the living labs. For example, the circuit board created by volunteers in the Verschwörhaus can be tied to sensors that measure air pollution or noise on crowded streets. One of the interviewees explains:

"You can measure stinky cars outside. That's what we've got cooking at the moment. We're trying to see if we can actually make an application with it, where in the best case we go into town with it. So, we have a sensor network for air pollution in the city". (Volunteer 2, Verschwörhaus)

The volunteer says that the data generated by the circuit board could help the city administration to improve the overall quality of life in the city. Similar outcomes are observable in GovLab Arnsberg. Here, the chatbot produced data on how many people were

using the service and what questions they had. With the help of these data, administrators identified user needs, which serve as a foundation for service improvements in the future.

As a third outcome, administrators and citizens gain digital competencies through their engagement in the activities of the living labs. For example, in the Verschwörhaus, citizens and administrators experimented with digital tools. For one of the interviewees this was a major innovative outcome:

“The Verschwörhaus offers a space, a platform, a room, to experience things in a very concrete way, to be able to try things out, and in such a way that in the end you somehow notice, experience, feel that there is a result. Yes, a result that will somehow help citizens”. (Deputy Mayor, City of Ulm)

A benefit only observable in the Verschwörhaus is that the participants deepen their understanding of technologies. This might be the case because the purpose of the Verschwörhaus was to provide a space for citizens and volunteers to experiment with technologies together with public servants. Therefore, it was equipped with the right tools, such as 3D printers. GovLab Austria and GovLab Arnsberg were closed spaces (in comparison to the Verschwörhaus), meaning that they were not open for regular citizens, only for internal users. Here, participants learned about new methods and tools and how to use them for their own projects.

4.3.2. Intangible Outcomes

There are two intangible outcomes produced by living labs: networks and changes in mindsets. The creation of networks was facilitated by all living labs. They were created because the labs provide a space to meet up and get in touch with others. Public servants built collaborative problem-solving competences, shared their knowledge, and expanded their own competences by engaging with volunteers. One interviewee described the benefit of this dynamic:

“I hope, that it is a mutual inspiration. I perceive it as such. We draw each other’s attention to things, which then, so to speak, sharpen our view of certain things and also make new things possible. In other words, knowledge is generated, trust is created, curiosity arises and the desire to try out more together arises. [...] The added value is access to information to which I would otherwise have no access. Access to this community to which I would otherwise have no access. The personal exchange that takes place. The work among like-minded people. Inspiring each other, this motivating effect”. (Sounding board member 4, GovLab Austria)

The living labs provided a foundation for enhanced collaboration because public servants who were usually embedded in a rigid hierarchical structure could meet members of the civil society or other public servants they would never have met otherwise. In the Verschwörhaus, the networks were created mostly between the volunteers who otherwise lacked a space to meet up and work together on problems.

The second intangible outcome describes the change in mindset of the administrators with respect to the digitalization of administrative processes, digital technologies, and implementation of new work practices. GovLab Arnsberg and the Verschwörhaus both produced outputs that made the benefits of technologies visible for decision-makers. For example, the chatbot developed by GovLab Arnsberg showed decision-makers that it is possible to develop a new service with a limited budget in a short amount of time without involving external consultants or IT service providers. This reduced the skepticism for digitalization that existed in the minds of decision-makers while they experienced the usefulness of the chatbot themselves:

“It’s because of these prototypes that people have, and that they can touch, that our managers have a completely different understanding of technology. They suddenly see what a chatbot can do. What it can do for them and where it’s positive for them. And then they get involved in a completely different way, selling it politically bottom-up”. (Head of GovLab Arnsberg)

The activities of the Verschwörhaus opened up the minds of the administrators and they got rid of their objections toward experimentation in public administrations. It had become acceptable to first try out new processes before implementing them by using the resources of the Verschwörhaus rather than expecting a perfect service solution provided by an IT service provider or a consulting company.

Another change in mindset was observed with respect to new work practices. The design thinking and prototyping methods used in the living labs were adapted by decision-makers and administrators:

“If I had to develop something now or if I was [. . .] in a workshop that is about developing a project, I would be thinking openly about a topic, to forget your background and to focus on the target group, this is something I implemented [in my way of working]”. (Participant, GovLab Arnsberg)

The City of Ulm planned workshops together with the Verschwörhaus where civil servants learned more about digital technologies and re-thought service delivery processes in a neutral space. As a result, new work practices spilled over from the living labs into the rest of the organization.

4.4. The Creation of Public Value through Living Labs

In this section, the public value framework introduced in Section 2 is applied to categorize tangible and intangible outcomes produced by the labs that lead to public value creation. The main finding is that the three labs mainly produce economic, administrative, and citizen values. Table 3 provides an overview of how each tangible and intangible outcome leads to a different kind of public value.

Economic value was created through the development of products and new services in living labs. For example, one participant of GovLab Arnsberg described how the beta-testing phase of the chatbot generated data on how the regional administration’s website was used and which questions the users had. As a result, the development of the prototype enabled the administrators to improve their existing web service. However, the creation of economic value is dependent on the implementation of the service. If the service developed in a living lab is not implemented on a large scale by the administration, citizens and other service users do not benefit from the improved service.

The first type of **administrative value** was created through the redesign of existing public services (GovLab Arnsberg) as well as the development of prototypes for new public services (Verschwörhaus). These prototypes produced data that helped the administration to improve their decision-making processes. As a result, the redesign of public services in living labs leads to improved administrative processes. The second type of administrative value was created through the participation of public servants in living labs. Public servants gathered digital competencies through experimentation and the application of design thinking methods. For example, public servants who created the chatbot learned how services can be digitized with low costs. This growth in knowledge can be interpreted as administrative value because the improved understanding of digital technology might have long-term beneficial effects for the overall digitization of government. The third type of administrative value includes changes in work routines and administrative processes. These changes occurred through changes in the mindsets of the public servants. For example, through participating in living labs, public servants learned to apply design thinking methods and implemented them in their daily working procedures. The fourth type of administrative value is the reduction of administrative red tape through the creation of networks which enable knowledge creation and knowledge sharing amongst the labs’ participants. As a result, processes within the parent organization are changed.

Citizen value was created directly through participation in the living lab and was not dependent on the implementation of the outcomes the living lab produces. Through participating in living labs, citizens had the opportunity to pursue their interests and voice their experiences. Furthermore, they gathered digital competencies by experimenting with technology. Consequently, if citizens get the opportunity to participate in living labs, which

was only the case at the Verschwörhaus, citizen value is created through their participation itself. It leads to the increased transparency of the service delivery process as well as increased satisfaction.

Societal value is an implicit value produced by living labs. Living labs enable long-term public value creation by offering participation activities. However, the societal values are long-term in nature because they are dependent on the implementation of the products and service improvements developed by living labs. This value was only identified at the Verschwörhaus because it was founded with the explicit goal to add value to the civil society of the city of Ulm. One reason for the lack of additional societal values produced by living labs might be that the living labs studied did not implement their prototypes on a large scale during the time of the data collection, so that long-term effects are not yet realized.

In addition to the different types of public value created, it was also observed that these types of value differed from lab to lab, depending on the level of government and the individual lab's strategy: In Austria, the living lab is located at the federal level and is primarily concerned with strategic operations rather than process innovation or the inclusion of citizens. The value GovLab Austria creates is related to the suppliers' side of government services: it mainly coordinates the efforts of Austrian public administrations to enable better service delivery and to introduce innovative methods in the process. The values created by the living labs located in Germany are directly related to the involvement of citizens and other users of government services. They provide a space for citizens and government officials to meet and redesign government services by using design thinking and user research methods. In summary, the value created by living labs is manifold and can be classified into four categories: economic, administrative, citizen and societal value categories. Due to the open nature of living labs, the value categories, especially the administrative and citizen value categories, are predominantly created through participation in a lab's activities and through the implementation of the produced output. The stakeholders influence the values created. Only the Verschwörhaus was, at the time of data collection, open for citizens. Therefore, citizens benefited directly through their participation. For GovLab Austria and GovLab Arnsberg, the benefits for citizens were created indirectly through improving existing services.

5. Discussion

The study was guided by two research questions: (1) Which organizational factors influence the process of value co-creation within living labs? (2) What outcomes and public value are produced by living labs? In the following section, it is discussed how the findings expand the existing literature on living labs and public value co-creation.

5.1. External and Internal Context Factors for Co-Creation

In response to the first research question, several context factors are identified (see Figure 1). The importance of top-level support is emphasized by [Tönurist et al. \(2017\)](#) and [Chronéer et al. \(2019\)](#), who highlight that the support from decision-makers outside the lab is a crucial condition for the lab's survival. Furthermore, [Whicher and Crick \(2019\)](#) note that top-level support contributes to the lab's legitimacy within the whole organization. The findings of this study expand the literature by showing how top-level support influences co-creation within living labs: it enables creative thinking, provides resources, and increases the importance of the lab to the rest of the organization.

Furthermore, different levels of autonomy and their influences on co-creation processes are presented. The literature on living labs provides mixed results on their autonomy. [Tönurist et al. \(2017\)](#) argue that lab autonomy matters for the lab's survival. [Timeus and Gascó \(2018\)](#) find that, when a living lab is isolated from the rest of the parent organization, the capacity to create innovations is limited. The findings here show that autonomy influences the speed of decision-making within the living lab and high levels of autonomy contribute positively to the lab's activities and outputs. One explanation for the different

effects of autonomy is that the context factors presented here might not be independent from each other. For example, the negative impacts of autonomy might be compensated for by strong top-level support. However, the data collected are not sufficient to make additional statements on how different levels of autonomy influence the survival of living labs in general or their overall co-creation capacities. To resolve these contradictory findings, future research is needed.

The findings on financial resources provide equally interesting insights. In the literature on living labs, it is generally assumed that a lab needs sufficient financial resources to survive (Chron  er et al. 2019; Gualandi and Romme 2019). This might be true for living labs that are fully independent and not part of a larger organization. However, a lack of financial resources is not necessarily a co-creation barrier. On the contrary, a small budget motivated the participants of one of the studied labs to find creative solutions. Future research is needed to test whether these findings are applicable to the general population of living labs or if they might be a result of selection bias inherent in the sample.

The most important internal factor is lab leadership. The leaders of the labs occupy important roles in the initiation and facilitation of the value co-creation process. The findings reflect previous research on the role of leadership as a crucial element in co-creation processes in general (Gago and Rubalcaba 2020; Chron  er et al. 2019; Juuj  rvi and Lund 2016). For example, Voorberg et al. (2015) show in their systematic literature review that a leader who acts as an entrepreneur facilitates co-creation that results in social innovation. Leaders in collaborative innovation are also described as facilitators or catalysts (Ansell and Gash 2012; Page 2010; Torfing 2019).

Furthermore, in two of the three cases, the labs' physical space and furniture is visually different from the rest of the organization. The interviewees reported that this different look and feel supported the stimulation of creativity. This is in line with Tiesinga and Berkhout (2014), who show that the look of a lab stimulates creative thinking and the co-creation atmosphere overall.

5.2. Outcomes and Public Values Produced by Living Labs

To answer the second research question, a diverse set of outcomes that result from the living lab activities was identified. In the initial coding, the existing distinction between tangible and intangible outcomes proposed by Hossain et al. (2019) was applied. Tangible outcomes in this study overlap with previous findings in the literature: products are one of the main outcomes living labs deliver (Dell'Era and Landoni 2014; F  lstad 2008; Leminen and Westerlund 2012; Mulder 2012; Veeckman and Temmerman 2021).

The intangible outcomes include changes in the mindsets of civil servants who are learning how to interact with different types of work and innovation practices. Changes in the mindsets of lab participants have not been addressed in previous research. The existing literature on living labs looks at cases that are not closely connected to their parent organizations. Instead, the creation of networks has been implicitly addressed by previous scholars who see living labs as a method to engage in knowledge sharing and the incorporation of different perspectives (Ballon and Schuurman 2015; Habiyaemye 2019; Leminen et al. 2012; St  hlbr  st 2012).

6. Conclusions

The aim of this paper was to extend the understanding of public sector living labs by identifying (a) the relevant factors that facilitate the co-creation processes of living labs and (b) the outcomes and public value created through co-creation processes in living labs. There are four external (top-level support, autonomy, organizational structure of the parent organization, and the lab's resources) and three internal factors (leadership, mindset, and motivation, as well as the physical space) that facilitate co-creation. Furthermore, the outcomes created through co-creation can be tangible (data and prototypes) or intangible (the creation of networks and knowledge).

Public value is created through the long-term implementation of the outcomes. This study showed that living labs co-create public value by enabling transformation processes within public administrations. In addition, there are changes in the mindsets of the civil servants participating in living labs. They enhance their understanding of digital technologies or try out new methods such as design thinking or experimentation. Benefits for society and public administrations result in the creation of products, services, and data. These outcomes help to improve the policymaking and service provision of the administrations on different government levels.

Overall, this study provides the basis for future research to study the conditions that enable co-creation processes as well as expanding research on individual outcomes of living labs. Using public value to conceptualize the outcomes of the collaboration of different stakeholders in living labs shifts the focus towards incremental outcomes. This value can be interpreted as complementary to the research stream that sees living labs mainly as a method and tool to enable innovation (Bergvall-Kåreborn and Ståhlbröst 2009; Gascó 2017).

6.1. Theoretical Contributions

This study contributes to theory development in three ways. First, in the public sector, living labs are mostly embedded in government structures (Lewis et al. 2019; McGann et al. 2018; Timeus and Gascó 2018). Therefore, this study contributes empirical evidence to support the understanding of context factors that facilitate these co-creation processes in a public sector context. Furthermore, there exists a body of literature on the co-creation of public service delivery (Nabatchi et al. 2017; Voorberg et al. 2015; Grönroos 2011). It might be possible that the external context factors identified in this study also apply to other co-creation processes outside the living lab context.

The second theoretical contribution refers to the concept of public value. The living labs in this sample created three different types of public value: administrative, citizen, and economic value. Prior studies have noted the unique types of value living labs create when they are implemented as innovation units inside public sector organizations (Gascó 2017; Hossain et al. 2019; Hansen and Fuglsang 2020). Therefore, existing theory on public value creation is expanded by demonstrating how public value is created by establishing in-house units for experimentation and user-participation that resemble methods of collaborative innovation among multiple different actors (Bryson et al. 2014, 2017; Sørensen and Torfing 2017). This is an addition to the literature on public value because the research focuses on public value creation through service provision (Bovaird and Loeffler 2012), and more recently, through the rise of e-government (Twizeyimana and Andersson 2019; Bannister and Connolly 2014). Furthermore, for the creation of long-term public value, the active contribution and direct involvement of public administrators is necessary.

Third, the findings are relevant for the open innovation literature. Living labs can be perceived as open and unrestricted collaboration spaces where knowledge is shared amongst the participants (Gascó 2017). More specifically, Schuurman et al. (2016) interpret living labs as a structured approach to open innovation because these labs follow user testing approaches that mimic scientific experiments. Even though the living labs studied in our sample lack rigid processes and rather experiment with various approaches, tools, and methods, they provide formalized institutional environments for the participants to engage in outside of the hierarchical structures of their parent organizations. The literature on open innovation in the public sector has identified several drivers and barriers for open innovation processes. For example, Mergel (2018) shows that open innovation processes in government might be restricted by legal aspects or the type of agency involved. Here, living labs might be used to create an environment where open innovation processes can be tried out in an experimental way with fewer costs and risks (Leminen et al. 2012) than open innovation projects organized by a single agency. In addition, Zhang et al. (2017) show that besides top-level support, the digital competencies of the public servants, and the economic and social contexts drive open innovation processes. Therefore, the context factors for co-creation identified in this study expand the knowledge on open innovation in

the public sector by showing how public servants can influence the success of co-creation and open innovation processes.

6.2. Lessons for Policy Makers & Practitioners

The findings are especially interesting for public management practitioners and policy makers who plan to establish living labs in their own organizations. First, the context factors uncovered in this research can be used to plan a living lab strategically and to ensure its success. Several context factors are relevant to design a living lab: top-level support, sufficient resources, and a capable leader of the living lab. Top-level support is crucial because a lab's legitimacy within an organization is dependent on how the representatives of top-level management support the lab. It is therefore important for public managers who want to engage in living lab activities to gain trust from their supervisors and ensure support even before the living lab is created.

In addition, policy makers and practitioners can ensure the success of a living lab by selecting the right leader. To manage the co-creation process properly, leaders need moderating skills to manage the various interests and needs of the lab's participants. Furthermore, leaders need knowledge about digital technologies and the parent organization. These skills enable the leader to communicate the lab's activities and outputs to decision-makers within the parent organization that lack this kind of special knowledge. Therefore, policy-makers and practitioners can use the insights described in this study to ensure a living lab's success.

The framework on public value enables practitioners and policy makers to gather support to establish living labs. The individual types of public value can serve as an assessment framework for both the initial goals as well as the measurable outcomes of living labs. Public managers can justify expenses by showing how living labs provide added value to the organization itself as well as their stakeholders.

6.3. Limitations

The research design has limitations that might influence the generalizability of the findings. First, the selected living labs are located exclusively in German-speaking countries with unique bureaucratic contexts and administrative cultures. Therefore, the findings might not be applicable to living labs located in other bureaucratic contexts. Second, the short tenure of the living labs limits the generalizability, because the context factors might play out differently in more institutionalized labs. Furthermore, the findings might not be applicable to labs that operate as independent organizations, because they are more autonomous than the living labs in this sample. Third, the internal validity of the findings is limited because of the data collection process. The interviews were conducted by phone which makes it more difficult to build rapport, and the interpretation of gestures or facial expressions is limited (Yin 2016). However, according to Flyvbjerg (2006), the generalization of results derived from single case studies is possible, if the case selection is theoretically informed. The cases analyzed in this study are unique cases because they were among the first living labs founded in a public sector context in Germany and Austria. The insights derived from this study are therefore valuable for policymakers and practitioners who might attempt to establish living labs in similar bureaucratic contexts.

To conclude, despite the limitations of the research design, this study provides an overview of relevant context factors that influence the co-creation processes within living labs. Furthermore, a framework to conceptualize the outcomes and public value produced by living labs is presented. Further research is necessary to validate and extend the findings.

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