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Article

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Abstract: This paper aims at a broad scan of needs for knowledge advancing living labs and broader customer value co-creation in shopping malls. Special attention is given to the meeting and social integration function and metaverse development. Living labs are understood as a methodology of co-creative and open experimentation that is customer-led in a real-life environment. Emerging metaverse development tends to change opportunities and limitations, about which almost nothing is known. The paper uses a qualitative approach in two steps. The first step explores relevant theory on systems, like retail systems, customer-value co-creation (marketing) and capability and personal traits in behavioural change (individuals), while distinguishing between three living lab stages, namely, anticipation, processes on the way, and ex-post evaluation. A few central themes that are becoming increasingly important are the emerging metaverse, if and how traditional malls can continue serving as physical meeting places, and the possibility they will change course towards new combinations of physical and virtual activity. In the second step, a broad array of knowledge-advancing needs is discussed, and this results in a smaller set of knowledge gaps on the basis of urgency, like interests of new ICT stakeholders in shopping malls, impacts from metaverse on site-specificity, and benefits and barriers of disabled persons. The paper also forwards the need for more attention to the ex-post evaluation of co-creation projects, which calls for standard protocols and AI-supported data systems. The paper closes with contributions, management implications, and ideas about future research.

Keywords: shopping mall renovation; living lab; co-creation; social integration; disabled persons; metaverse

1. Introduction

1.1. Setting the Scene of Living Labs

Living labs are conceived in this article as an experimentation methodology through which users (consumers), in collaboration with other stakeholders, participate in the design of innovative solutions in a real-life environment. Living labs have significantly increased in popularity through their collaborative and co-creative character [1–6]. In general, living labs are applied to several sustainability subjects that are climate and environment related, but the subject of this article is related to equality and social integration (UN Sustainability Development Goals (SDGs) [7,8]).

Several related background trends have firmly anchored living labs as a methodology in experimentation into (urban) planning and value co-creation in a retail context. The first trend is to foster citizen participation in the design of new public services, which originated from the initial idea in the 1990s for design policy responses that better matched new demands. This occurred after a long monopoly by officials in which citizens merely acted as passive consumers [9–12]. In this vein, active user participation was also seen as a kind of broad democratization [13,14]. Further, as a new trend, changes in the relationship between science (university) and society played a role in the increased attention to citizens' initiatives. Accordingly, knowledge production at university started to become more socially distributed and subject to multiple accountability checks [15–17], reinforced by

a more prominent position given to civic society actors in knowledge production, with citizens as participants in addressing social justice and the resolution of societal challenges. In a similar vein, in business innovation, users (customers) have become recognized as an important information source for innovative design, and subsequently, the customer-active paradigm started fostering business models of customer/user co-development and co-creation [18,19]. Next are new trends in information and communication (ICT) as enabling technologies in experimentation on environmental qualities concerning public protection and safety in streets and squares. Functions like these have come together in so-called Smart Cities and ambitions using digitalization and integration of data to increase local communities' quality of life [20,21]. Retail-centered initiatives aimed at social integration, whether physical, digital, or both, are often part of Smart Cities' ambition to improve the quality of urban life. We mention that the methodology of living labs (as customer-centered co-creation) is also used in a broader context of retail marketing. This use serves to identify the best customer value and business models, increasingly in an emerging metaverse environment (multiple channels and realities) [22].

1.2. Special Attention: Social Integration

One of the first living labs has been applied in retail activity in Finland. At the time, around 2008, a large national retailer/grocery store initiated collaboration between main stakeholders to develop a new business concept through a better understanding of digital services that improve actual daily shopping [23]. At the same time, shopping malls, as the focus of this article, started to be seen as an opportunity to bring people together and foster interaction as part of a larger reshaping of the urban built environment and ecological fabric to the benefit of health and well-being. Accordingly, mall environments preferably enable social interaction and social integration with regard to (cultural) minorities, migrants, disabled people, and older people [24,25]. The urgency of social integration policy, particularly regarding disabled people, can be presented as follows. On the medical side, an increasing frequency of disabilities can be observed. By taking the current US population as an example [26], it becomes clear that compromised mobility is one of the most common disabilities, i.e., 12 percent of the population live with serious mobility difficulties, such as when walking or climbing stairs. Further, 13 percent live with a cognitive disability, 6 percent with a hearing disability, and 5 percent with a vision disability. Most disabilities, particularly coinciding disabilities, contribute to social isolation and call for extra effort in social integration (inclusion). Due to the aging of the population, in some areas, the number of disabled persons is growing [27].

1.3. Motivation: Shopping Malls in Metaverse and Shortage in Evaluation

Shopping malls differ in age and construction, and they are more or less specialized in goods and assortment and in targeted customer segments. In this context, attention in the literature has specifically moved to mall accessibility for physically disabled persons and their rehabilitation [28–31]. The subject matter is full of challenges but also with complexity, i.e., due to a large, yet badly known, variation in behavioral response by disabled persons to improved accessibility from a capability approach [32,33]. In this framework, 'traditional' marketing in retail [34–36] seems to be followed by a new co-creative marketing (customer value creation) using e-commerce, social media, artificial intelligence, virtual and augmented reality, multiple connected channels, and newly integrated realities blending the digital and physical in a metaverse strategy [37–39]. In this emerging change, social integration seems somewhat lost.

While customer value co-creation has been used in 'traditional' retail marketing, broadening to the metaverse is new and points to questions of the survival of 'traditional' shopping malls or the radically new functions of malls and the resulting consequences for social integration. These new, broadening metaverse developments motivate the objective of this article, namely, to identify knowledge gaps in living lab methodology as well as shopping mall rehabilitation and social integration in an emerging metaverse environ-

ment [28–31]. Specifically, this paper's objective is to identify and explore knowledge gaps in anticipated learning and the ex-post evaluation of living lab results. Several scholars have composed lists of critical conditions in the performance of living labs, but a comprehensive and large-scale evaluation of living lab results, enabling statistical generalization and larger usability, has remained underdeveloped [5,40–44]. Nevertheless, there have been attempts to design protocols.

1.4. Research Questions

With regard to the current state of the shopping mall's reconstruction and social integration of disabled persons, most interventions are concerned with the mall's physical accessibility for wheelchairs and specific customer (welcoming) services (Appendix A). Attractiveness may also be enhanced by the supply of leisure services and open attractions, like seasonal and farmers' markets or antique markets and fashion shows, and by functional integration in the mall with adjacent sport and leisure facilities, hotels, cinemas, theaters, a concert hall, etc. Regarding relative location in the city and adjacent city quarters, some malls may lack connections (so-called island malls), while others are well integrated with adjacent (living) quarters and transport infrastructure. All-in-all, shopping malls are different, and so may be the living labs or the broader value co-creation implemented. However, the outcomes of experimentation concerning the shopping behavior of disabled persons, or of any other customer category in value co-creation, are only partially understood in a retail industry system that tends to be in fundamental change under the influence of metaverse [22,37–39].

To respond to shortcomings in understanding, two research questions are addressed in this article in an exploratory approach to living labs performance: (1) Which theoretical perspectives would enable a preliminary analysis of shopping mall living labs and broader value co-creation in the emerging metaverse, with the aim to reveal knowledge gaps? (2) What (disciplinary) knowledge and reflection are required in the practice of shopping mall living labs and broader value co-creation in different stages, and which urgent issues are involved?

1.5. Method and Materials

Section 2 outlines a framework of (theoretical) perspectives that contribute to the understanding of shopping mall living labs and broader value co-creation, in particular, social integration in the emerging metaverse. These perspectives are (1) organizational (system) change [45–47], specifically in the retail industry system, (2) marketing perspective in changing retail activity [22], and (3) shopping behavior in a capability and personality traits approach [32,33,48–50]. Further, Section 3 presents a discussion of the need for knowledge advancement, distinguished for living lab stages of anticipative learning, processes on the way, and ex-post evaluation of performance. This results in a list of urgent knowledge needs. Finally, Section 4 outlines practical implications, including management and marketing, as well as limitations and suggestions for future research.

The present article relies on a mix of sources, including literature study, expert interviews and discussion (expert meeting), and in situ participant observation. The expert meeting took place in Switzerland (Solothurn), as CitSciHelvetia'23 'Impact through Participation', 29–30 March 2023. The main participant observation was in Alexis Nihon Mall in Montreal, Canada [27–30]. This mall is part of a multipurpose complex built in 1967 and required renovation in the 1990s. Participant observation was also undertaken in a more recently constructed (2008) shopping mall annex leisure center (West-Side) in Bern (Brünnen), Switzerland. The two shopping malls are contrasting cases of different ages (construction period and architect's visions) and locations, namely, close to the inner-city area versus the fringe of the city, with concomitant differences in available room, such as for an extended mall with a leisure center. Furthermore, the older mall has adopted an explicit policy aimed at the social integration of disabled people, but the younger mall has applied new understandings of mall construction in improving access and social integration in a

'natural' way. Finally, the analysis is informed by a general understanding of living lab practice derived from the literature studies and previous works of the author.

2. Literature Review

2.1. Introduction

In response to the first research question, three related theoretical perspectives at different levels are discussed; briefly, these are as follows: (1) organization (system) change, (2) marketing perspectives and customer value co-creation, and (3) capability and personality traits in customer shopping behavior change. The three perspectives and the rationale for selecting them will be discussed below. We mention that while new communication technology (metaverse channels, imaginary, etc.) works at the organization (system) level, we discuss dealing with this factor in more detail on the level of individual shopping behavior change (Section 2.4).

2.2. Organization (System) Change

The perspective of the organization (system) change is often used in the literature on socio-technical sustainability areas, like in fighting climate change and improving urban water management [51,52]. The subject matter in this paper is different; namely, it pertains to changes in the retail industry as a result of the emerging metaverse and concomitant changes in the (urban) social-ecology system, specifically social integration. This section will focus on changes in the retail industry (system), which is in the process of quick and radical restructuring, namely, that derived from e-commerce and the comprehensive merging of gaming, live events, social media, augmented reality, etc., blending the virtual and physical through multifaced interactivity (metaverse development) [22,37–39,48,49]. The most important change tends to be a weaker connection with place (however, computers and the like need to be physically installed) with, importantly, increased virtual access to a multitude of places, persons, and events, and a mix of information and sensation, be it visual, oral, intellectual, emotional, etc. [37].

The theory of change [45–47] provides a model of change processes as a description and explanation of how and why an activity or set of activities (as intervention) is expected to lead (contribute) to comprehensive change. Strong attention is given to causal processes that are inherently complex, including non-linear nature with multiple interactions and feedback loops. In addition, it is emphasized that the influence of intervention may change over time and/or space (e.g., weakens when developing from sphere of control to sphere of influence and sphere of interest). There are also mechanisms at work that may delay system change, like pricing mechanisms, traditional regulation, limited user comfort, inadequate supporting technology, and the presence of stakeholders with diverse interests. The nature of changes and the pace in which these unfold may differ across the retail industry system (sector), presumably leading to differences in (new) opportunities for social integration. An example is retail connected with on-site services, like in beauty and health treatment, compared with retail without such physical services.

As indicated above, certain stakeholders may be powerful in enhancing or delaying change processes [29,53,54]. The multi-stakeholder perspective in this context emphasizes stakeholders' different problem perceptions and values in thinking about solutions rooted in diverse interests and resources. In the 'traditional' situation, great importance in mall reconstruction is attached to economic interests by real estate owners (mall) and shopkeepers, as well as construction firms. Meanwhile, related universities and research institutes (clinics for rehabilitation; faculties of architecture and functional building' design) and municipalities/local community organizations act in the interest of social integration and well-being. Adopting the metaverse and metaverse shopping, however, seems to happen under different stakeholder dynamics, in which ICT companies tend to be important.

2.3. Marketing Perspective

Modern retail is increasingly a mix of buying in situ in shops and online through websites (apps), with influence, among other factors, coming from social media (influencers) views on products and services quality. The key concept for retailers in the central parts of marketing is customer value co-creation, meaning the interactive identification and design of products/services with the best value-added for distinct customer segments.

With regard to the emerging metaverse, encompassing physical shops and digital presence, AI technology and augmented reality, etc., the marketing perspective reveals that a lot of knowledge is missing about the character (opportunities and limitations) of metaverse marketing activity. However, understanding is quickly increasing in the current day, like in financial services and fashion and furniture design [22,48,55,56]. An example of metaverse use by retailers in furniture is providing augmented reality apps that allow consumers to 'see' how furniture fits in their house. In this vein, the potential of augmented reality points to several challenges in retail living lab practice (experimentation and testing) in improving access and mobility in a physical shopping mall and also to challenges in a general increasing of customer shopping experience and mall attractiveness (augmented reality seen as entertaining and enjoyable). However, in the context of comprehensive changes, fundamental issues, like the survival and innovation of current retail concepts in shopping malls, as well as the emergence of human–computer barriers among customers, remain poorly known [50,57,58]. The last observation is related to the next section.

2.4. Capability and Personality Traits Approach to Behavioral Change

With regard to customers and behavioral change, the theoretical perspective we introduce is a mix of capability approaches, in particular personality traits and construal level theory. These will be discussed below.

First, the argumentation in the capability approach can be seen as follows: increased physical (social) accessibility of shopping malls provides several opportunities and is 'shaped' by individuals as their capability to eventually engage in several out-of-home activities, which they value, and this may lead to intended well-being. The following underlying personal features (sometimes overlapping) tend to hamper perceiving such opportunities, namely, age (older), income and education (lower), handicap (more heavily), etc. In the relatively new capability approach, with emphasis on equity in opportunities [32,33], it is recognized that vulnerable persons may require additional resources to achieve similar levels of well-being as others.

Secondly, in the personality traits approach [57–59], the focus is on the personal 'driver' side (motivation) of the adoption of change (communication technology inventions), specifically by attaching importance to traits like openness to experience, consciousness, agreeableness, and extraversion, extended with price-value, habit, and hedonic motivation. In this vein, the capability and personality traits approach could be adopted to better understand participation in augmented reality technologies (imagination). Thirdly, the construal level perspective is more specific, where attention is focused on the interaction between the new technologies and psychological distance [48]. As previously indicated, augmented reality reduces physical distance and may better facilitate customer communication in shopping. The use of augmented reality interactive technology enables one to view products (e.g., clothing, jewelry, make-up) worn by customers themselves. Thus, through dynamic product imagery, the gap (distance) between online and offline is decreased, thereby enabling customers to better decide on buying and increasing customer satisfaction [48].

Finally, it is worth noticing that the above-mentioned social–psychology studies reveal the additional influence of cultural setting on the adoption of metaverse as a behavioral change. Moreover, some methodology issues call for additional research, like the self-reporting character of many studies (causing potential bias) and the use of cross-sectional analysis, while a longitudinal approach would provide a better understanding of behavioral change.

3. Needs for Knowledge Advancing

3.1. Introduction

In this section, attention turns to the second research question, namely, the advancement of (disciplinary) knowledge and reflection needed in a living lab approach to improving benefits from shopping malls' increased accessibility (physical and virtual). This falls into three (stages), namely, preliminary or anticipative learning, which is required prior to the actual experimentation (Section 3.2); additional knowledge advancement, for example, focusing on input, processes, and output (Section 3.3); and ex-post evaluation (Section 3.4). In the final part, urgent knowledge advancement is briefly addressed (Section 3.5). Further, the need for knowledge advancement is structured around the three theoretical perspectives addressed in the literature review while drawing on general insights from the literature study, including the metaverse [5,43,59,60]. Highlights and specific details are presented in tables for each theoretical perspective. It is worth noticing that the section introduces 'normative' insights that are assumed to contribute to the efficient and effective performance of living labs and broader customer value co-creation [60].

3.2. Preliminary (Anticipative) Learning

The results on important types of knowledge advancing below are derived from several studies on living labs (specifically on shopping mall access), and this is completed by a brief scan of websites on knowledge needs connected to metaverse development.

Using a system (change) perspective calls for a problem definition and problem demarcation), followed by a preliminary problem analysis of factors and actors, the latter including mall owners, shopkeepers, visitors (incl. disabled), rehabilitation professionals, and experts in removing physical accessibility barriers [29].

Knowledge advancing on problem features and causal background has often (partly) been missing in the practice of living lab use [5,60] but has recently been increasingly applied to consciously support decisions on living lab aims and design. Similarly, knowledge advancing on site-specificities of the malls' buildings and location has been missing, making replication elsewhere a difficult task [61–63], but solid attention is growing. However, at the same time, the metaverse tends to complicate the situation. Further, seen from a collaborative marketing viewpoint, the following issues call for attention to knowledge advancement. First, attention must be paid to the selection of stakeholders (including customer segments) to be involved in collaborative learning and co-creation of designs/solutions. Key points of attention are the degree to which stakeholders are represented when addressing the problem (area) and ways to keep selected stakeholders involved after their initial enthusiasm. Secondly, there is not sufficient knowledge on how to mix experiments on physical accessibility with those using new communication technology in the metaverse (like AI and augmented reality) and how to pay attention to the co-creation of new customer value [48].

It is also important to reflect on the underlying planning models. These models could be somewhat flexible and adaptive, in which early living lab results may provide the basis for some adjustment of (sub)goals later on, or by contrast, be more strict like those derived from precede–proceed thinking [64]. Precede–proceed models work by guiding planners to think logically about a desired end-point and move "backwards" to achieve that goal. In living labs, such a planning process is broken down into several subgoals, but the question arises whether such a planning model is adequate in dealing with upcoming complexity from metaverse development. More details are given in Table 1.

A supportive strategy to increase understanding of the problem and to decide on interventions is using a simplified input–output diagram (Figure 1) [5]. Applied to a living lab, one may conceive several inputs (interventions) derived from anticipative knowledge advancing and tools to facilitate open and collaborative learning processes, experimentation, and design ('outside the box' and 'in the wild'), next to inputs concerning planning and budget. However, there are also external factors beyond the control of living lab management that need to be taken into account, like unexpected competition from nearby newly built shopping malls/leisure centers and competition from new digital

opportunities. Further, on the outcome side, there are intended results and, eventually, unintended results. It is worth noting that in evaluation studies, Figure 1 can be extended on the output side, with a study of long-term impacts [46,47], like increased customer satisfaction and medical well-being, eventually derived from more frequent and lasting contacts, enhancing interpersonal contact [28,29].

Table 1. Knowledge advancement in anticipative learning in living labs and other co-creation at three levels: (a) (b).

System (Change)
-Explore problem features like problem structure and influencing factors (causal background); multiple stakeholder involvement (dynamics); changing retail business- and marketing models, mall construction standards, standards in digitalization, and influences beyond control;
-Explore site-specificity and specific mall (re)construction (see Appendix A), external accessibility, interior (re)construction, environmental/social accessibility, and attractions; integrate living labs with higher level (municipal) policy on social integration and retail;
-Explore uncertainty and define how to deal with uncertainty.
Collaborative Marketing
-Define goals, subgoals, timelines, and underlying planning models;
-Define expected output and impacts with regard to required collaborative learning processes and end goals, including certain flexibility (given uncertainty);
-Selection of stakeholders (incl. customer segments) derived from representativeness;
-Selection of co-creation methods (common shopping trips, augmented reality, etc.);
-Explore complexity in a mix of traditional experiments with experiments on metaverse technology (digitalization, AI, augmented reality interactive technology (ARIT, etc.)) and explore new models of customer co-creation;
Capability and Personality Traits
-Define customer segments of interest, particularly in a social–psychology sense (also taking account of distinct cultural settings);
-Design measurement and monitoring of behavioral changes of subgroups of customers and their capabilities in physical and virtual (psychological distance); plan specific attention to subgroups of disabled customers.

(a) Not mentioned in the table: general planning issues like living lab plan/planning budgets, deliverables, and timelines (incl. flexibility). (b) The three perspectives are in bold.
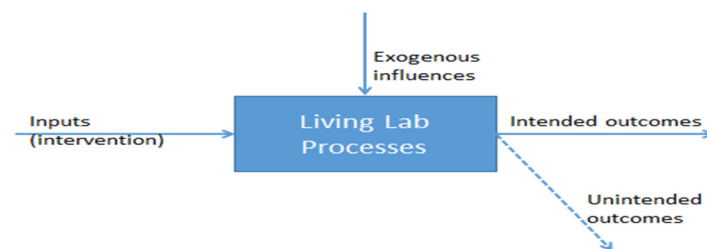

Figure 1. A simplified model of living labs. Source: [5].

Finally, anticipative knowledge advancement is needed to increase understanding from adopting capability and personality trait (motivation) perspectives. This may include preparing how to deal with differences between individual persons' capability in appreciation of increased mall accessibility, as well as how to deal with different personality traits (motivation) in appreciation of metaverse channels, particularly, differences in 'psychological distance' [48,50,57–59]. Though major progress has been made in university research, there is still practical complexity that is not yet been solved, like that stemming from cultural influence and missing longitudinal views on behavioral change.

3.3. Additional Knowledge Advancing on the Way

Knowledge advancing on the way of living lab practice and other customer value co-creation includes management, monitoring, and providing of feedback. Further, upscaling of mall living lab results (partially) to system level tends to remain a major issue (Table 2). However, due to the emergence of the metaverse and new business models, 'traditional'

living lab results may quickly become outdated and need to be adapted to mixed shopping malls and home solutions. On top of this is the (large) variation in site-specificity of shopping malls (in transport connections, proximity to several living quarters, etc.) and the broader situation of social integration in adjacent living quarters [60–64]. What may help to upscale living lab results to the city/region level, is the prior integration of the living lab plans in local/regional retail policy and social inclusion policy.

Table 2. Knowledge advancing on the way in living labs and other co-creation (a).

System (Change)
-Monitor (radical) system changes (incl. emergence of new, powerful stakeholders);
-Management of upscaling of living lab results by integrating them in broader local/regional retail policy and innovative digitalization, in social integration policy (urban ecology), and connecting with platforms on site-specificity.
Collaborative Marketing
-Management of key interactive communication and co-creation processes, leading to customer-driven value-creation and solutions (e.g., new business plans);
-In more detail, preserve open and inclusive knowledge co-creation and design, avoid negative sentiments, and eventually, drop out of participants;
-In more detail: management of an adequate mix of experimentation modes, e.g., social action observation, interviews in shopping trips, simulation;
-Monitor whether subgoals are reached.
Capability and Personality Traits
-Monitor outcomes of subgroups of customers in behavioral change, e.g., in mall visits and use of metaverse channels with time expenditure, the emergence of new customer added-value, improvement of the physical and cognitive condition of mall visitors, improvement of social integration ('causal chains');
-Explore emerging human–computer challenges but also barriers.

(a) The three perspectives are in bold.

With regard to needs for monitoring, serious controversy between stakeholders has remained absent in 'traditional' mall reconstruction and rehabilitation of disabled persons, but this may change with the broad application of metaverse technology under the influence of powerful ICT players if these have different aims compared to shopping mall owners and municipalities, etc. The emergence of such uncertain developments calls for monitoring and, eventually, adaptation to new situations. Further, anticipated management includes the creation and elaboration of open and collaborative learning and co-creative design, steered by an adequate mix of tools and roles, such as social action projects, interactive shopping trips, and simulation sessions in workshops using virtual and augmented reality. In addition, preserving a good mood and inspiration among participants is important, as misunderstandings, negative sentiments, and conflicts may arise due to unexpected (disappointing) results, etc., with the risk of participants dropping out [65,66]. These situations are a challenge to prevent (mitigate). A compelling question that remains open is whether customer value co-creation in metaverse points to a persistent (increasing) need and persistent opportunities to visit physical shopping malls and enjoy benefits from meeting (other) people in person or, adversely, if it points to a declining need and declining opportunities. Moreover, the question of how disabled persons may be affected also remains.

3.4. Ex-Post Evaluation as Knowledge Advancing Activity

Ex-post evaluation is one of the most pervasive knowledge-advancing activities, as it aims to understand multiple sides of the performed experimentation methodology. This also means that ex-post evaluation of living labs experimentation tends to be heterogeneous in many respects, in particular regarding the 'what'. For example, there may be a focus on the implementation of required processes on the way, like collaborative learning and design of solutions or business models, or on the realization of expected end results, like behavioral changes and upscaling to a system level. Whether the living lab results have been gained in an effective and efficient way is another aspect of the 'what' in the evaluation studies [43,60].

Most recently, a comprehensive set of defining characteristics of living lab evaluation has been forwarded, including next to the what, the who, why, ways, where, and when in the evaluation [44]. These characteristics, which also apply to shopping mall living labs, are worth solid reflection in the planning of evaluation, for example, the ways (qualitative and/or quantitative analysis, or a mix) and when (evaluation at the end of the project and/or a few years later to depict indirect impacts), etc. Specifically, the who question is relevant for the following reason. In collaborative problem analysis and co-creative design of solutions, understandably, the evaluation of results is also organized on the basis of collaborative participation. This means, for example, aside from the living lab managers, (disabled) visitors, shopkeepers, shopping mall managers, municipality representatives, and rehabilitation officials. Choices in the above aspects of living lab ex-post evaluation are preferably made on the basis of consensus.

With regard to the evaluation methodology of living labs in general, many valuable social action studies have been performed, drawing on a case-study approach [67,68]. However, a statistical approach drawing on a representative sample that enables statistical generalization is still missing. This situation tends to prevent the design of an adequate mix of evaluation methodologies [42–44], which is important because of the complexity of the evaluation of living labs. The following reasons for complexity can be forwarded. Causal relations are characterized by multiple causality, non-equilibrium, non-linearity, eventually with irreversible tipping points, feedback and feed-forward mechanisms, etc. [69]. Other complicating situations in evaluation refer to the quality of data, specifically, data on opinions and well-being feelings that are often incomplete, biased, and overall fuzzy, and this tends to be more often the case if data are collected through self-reporting web questionnaires. Such circumstances call for the conscious selection of evaluation data and methods on the basis of protocols that need to be developed and standardized. The first steps are currently being taken [70]. In addition, it is worth noticing that data quality is increasingly improved by the application of AI in data collection and interpretation, enabling better use of fuzzy and incomplete data and resolving multiple complexities [71–73].

3.5. Urgent Knowledge Advancing

We present three sets of (related) knowledge gaps derived from the urgency of the missing knowledge in preparation for experimentation in living labs and related co-creation. Urgency refers to knowledge advancement in the short term due to the pervasiveness of (expected) changes. Specific attention is given to metaverse developments and the social integration of disabled persons.

- System level: problem analysis of mall accessibility in mixed real/metaverse while learning from ex-post evaluation of past/current projects; impact from metaverse on opportunities and threats in shopping malls' functions; changing influence of site-specificity of solutions in mixed real/metaverse situations; role of new ICT stakeholders (interests) in mall retail industry.
- Collaborative marketing and broader learning/design: mixed real/metaverse experimentation and role of suppliers and customers; creation of robust/valid outcomes of customer value co-creation and living lab experimentation (disabled persons) in open and inclusive learning and design, in mixed real/metaverse circumstances.
- Capability/Personality traits in behavioral change: experimentation and use of subgroups, in particular, disabled persons; accessibility of metaverse channels and development of new causal chains (from increased mixed real/metaverse accessibility to social integration); emphasis on human–computer benefits and barriers, and cultural influences.

4. Discussion

4.1. Theory Contribution to Identifying Knowledge Gaps

Our exploration of relevant theory perspectives has shed light on several knowledge gaps that refer to the emerging mixed physical reality and metaverse in mall shopping.

Using this approach turned out to enable a first realistic scan of such a broad field of missing knowledge and understanding, as well as identifying several urgent knowledge advancing. The latter refers to changing shopping mall activities in mixed real/metaverse conditions (survival of 'traditional' activity and buildings), mixed real/metaverse experimentation and creation of new customer value in marketing, and accessibility of metaverse channels, specifically social integration and benefits for disabled persons.

4.2. Practical Implications

Given the many knowledge gaps, there are three overarching results. First, the range of disciplines and approaches involved in mall living labs tends to be (very) broad in responding to knowledge needs, covering, among others, urban retail studies, social ecology, policy analysis, marketing experimentation, social psychology, evaluation methodology, data systems, artificial intelligence, simulation, and augmented reality. Secondly, the focus on knowledge advancement is preferably also on the process side of management, namely, knowledge on preparation of design and planning of the experimentation and of ex-post evaluation. Thirdly, and connected to previous points, there is the need for priority setting of specific knowledge advancing over other ones (eventually in a participatory manner) and for protocols for data collection. This situation also comes with the need for support from living lab data systems/platforms. First steps have already been taken in the creation of protocols and (partial) data systems/platforms [61–63] concerning site-specificity, but it seems that the complexity of social integration and pressure from metaverse development cause different opinions and eventually delays in these first steps.

4.3. Management and Marketing Implications

Key in marketing management would be to consciously select customers that are representative of the challenge (problem) while also accounting for different capabilities and personality traits (in accessing metaverse) and to consciously select a mix of co-creation modes (shopping trips, augmented reality trips, interactive workshops) while monitoring the validity of the learning and co-creation outcomes.

Further, if we support the 'traditional' view that social integration is best in meetings in person and personal interaction in groups, shopping mall managers are facing the challenge of attracting customers (including disabled persons) to visit the shopping mall. Such a challenge is not entirely new but will be more compelling in the metaverse in searching for an expansion of the shopping functions into adjacent leisure areas and the introduction of any other function that matches shopping, like visiting an exhibition and introducing the metaverse where functional. Such 'packages' use personal subscriptions and provide customized welcomes, inspiring instruction, and guidance. They are exemplified in food and healthy cooking workshops, eventually including group visits to nearby herb gardens or biological farming (or using augmented reality), and in customized gaming equipment 'journeys', with workshops in a gaming studio and visiting nearby topics and sites of gaming in the city. Improving such links with physical mall shopping seems a major challenge for shopping mall marketing managers, and it can be assumed that well-prepared living labs play a crucial role in the experimentation concerned.

In general, managers can be advised to perform end-evaluation not only on an individual case basis (social action) but to connect with several similar living labs, like in European Union research projects, and to benefit from joint facilitation and knowledge advancing and from opportunities to arrive at results that can be generalized statistically and eventually AI supported. Also, early use of data systems and platforms may increase the chance to benefit from end-evaluation in a quick manner. Such advice could also be given to branch organizations or other umbrella organizations connected to shopping malls.

4.4. Shortcomings and Future Research

The present paper is a *scan* of knowledge needs concerning customer co-creation experimentation in shopping malls, with special attention given to living labs with disabled

persons and to (potential) changes due to the emerging metaverse. The present scan has been informed by a different theory, including the retail industry (system), customer value co-creation in marketing, and customer capability and personality traits in behavioural change. Such a broad approach implied that opportunities for in-depth analysis could be signaled but could not be elaborated.

An important practical example is change in today's shopping malls (facilities) taking place under the influence of the metaverse and the types of customers involved. Some changes have already been investigated, like in fashion design and financial services, and may point to the decreasing importance of physical shopping malls. However, as the metaverse opens doors to scenarios (simulated events and objects) that otherwise could not be experienced as a participant, special attention is needed for disabled persons and how metaverse shopping may influence their opportunities for new social interaction and integration. First, practical human–computer interaction barriers may be at work, for example, those related to hand controls, small buttons to press, and joysticks to grab, aside from hindrance by stiff wheelchairs [74,75]. Secondly, whether the metaverse is actually used for shopping tends to depend on personal capability factors and personality trait factors. All such factors deserve deeper reflection and study, including ways to remove (technical) barriers (among others for disabled persons), which several companies and public actors have already started through adapting hardware and software and design of training. A specific avenue for future research would be to develop specific practical experimentation programs in instruction/gaming rooms in shopping malls, thereby stressing learning about technical opportunities but also about enjoyment and pleasure in the metaverse.

Appendix A

Table A1. Mall reconstruction in a context of integration of disabled (wheelchaired) people ('traditional' situation).

Potential Interventions	Detail of Interventions
Improve external mall access (a)	• Public transport stops/stations, specific parking lots, and connecting paths (pavement) without thresholds • Integration with adjacent city-quarters (to prevent 'island' shopping mall) through sharing of happenings, appointments with local inhabitants
Improve layout and wayfinding (a)	• Simplified layout, spacious corridors; communication of layout (wayfinding signs; navigation software)
Improve internal mall access (construction)	• Adjusted ramps, elevators (location); curbs, stairways, shelves, aisles, and maneuvering space; shop doors; meeting places; dressing- and restroom facilities

Table A1. *Cont.*

Potential Interventions	Detail of Interventions
Increase environmental and social quality of shopping visits and meeting places	• Adapted lightning (reflection) and acoustics (from mall and shop music and echo) • Prevention of crowding at spots that hinder moving • In-shop and in-restaurant welcoming and convenience customer services (contact with shop-keeper/restaurant manager; sensitizing personnel) • Shopping and restaurant appointments • Informal meeting places and open attractions (markets, shows, etc.)
Integration of shopping with other leisure activities	• Easy participation or acting as audience in activities like sports (swimming, ice-skating), fitness studios, plant/animal gardens, cinemas, libraries, art galleries

Source: compilation by author (derived from literature and participant observation). Since the (early) 1990s, many countries have adopted a standard system of physical access for newly constructed shopping malls, like ADA standards in the US. Older malls, e.g., built in the 1960s, have not been involved.

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