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Cross-cultural differences in user-centred research: An international living lab survey

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Abstract

Digital health applications and interactive technologies increasingly allow organisations to transcend national boundaries and expand the provision of tools and services to communities across the world. Making the transfer beyond the context in which applications were originally conceptualized is challenging, as these have to be tailored towards local end-user needs and regulations. Such information is not always readily available, which risks successful uptake in novel settings. Living labs help to bridge this gap, by performing user experience research and supporting user-centred design for cross-border projects. Dissimilarities in recruitment and participation of end users could however influence study outcomes. Therefore, this study explores to what extent living labs are aware of potential cross-cultural differences. The sample consists of 36 living labs from 20 countries, most focusing on health and care, the silver economy and information

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technology. Regional differences are reported on participants' motivation and on the impact of gender, age, professional status and socio-economic status on participants' contribution. Awareness of potential differences during recruitment and grouping and supporting equal contribution in sessions could improve the quality of user-centred research in international contexts, while still maintaining sufficient standardisation. Further research with larger international samples is needed to replicate and extend these findings.

Keywords
cross-border research, group dynamics, living labs, recruitment, research methodology

Introduction

Policy makers and organisations are becoming increasingly aware that technological innovations can contribute to the management of global challenges in ageing and health. The 'Silver Economy' (the market related to ageing and the population of over 50 years old) is estimated to contribute 5.7 trillion to Europe's economy by 2025 and will generate many new products and services in the area of health, care and technology.[1] In this constantly growing and globalizing market of digital health applications and other interactive technologies, it is paramount that innovations meet an existing need, fit into the context of use, are user-friendly and are designed in accordance with local regulations. User-centred design covers a wide range of activities with end users that are increasingly being performed by so-called living labs. Governmental and international bodies (such as the European Union) are promoting living lab methodology for innovation.[2] While different interpretations exist, living labs can generally be defined as open innovation systems where end users and other stakeholders are involved in the exploration, co-creation and evaluation of solutions in realistic circumstances.[2] Living labs provide cooperative spaces where stakeholders of innovations (e.g. citizens, regulatory bodies, healthcare professionals, developers, etc.) can exchange ideas, usually in iterative cycles, with the goal of facilitating the development of new solutions. Living labs can be active in different sectors, such as health and care, smart cities and regions or social inclusion, with many living labs reporting activities across multiple sectors.

Living labs can improve the understanding of factors contributing to the success of innovations in different social, environmental and cultural contexts.[3] Developers making use of living labs have been shown to benefit of such research in terms of gaining new insights, being able to test product-market fit and achieving positive economic effects.[2] Living lab organisations are increasing across Europe and there is a noticeable rise of these labs in the rest of the world as well, which facilitates international user-centred research.[2] Many parts of the world are facing comparable challenges (e.g. in relation to the silver economy) and might benefit from the implementation of similar innovations. While this means that developers can reach a substantially bigger market, circumstances and requirements for services and products can vary depending on the region in which they are introduced.[4] Obtaining relevant information on local preferences and customs in respect to a service or design can facilitate successful dissemination across borders. However, dissimilarities in the recruitment and in the participation of end users in different regions could influence the outcomes of international studies.[5] Therefore, it is important to investigate the influence of such cross-cultural differences and make adjustments to study protocols accordingly.

Cultural differences are of interest for the development and implementation of innovations. In the past decades, frameworks from cultural psychology have increasingly been applied to business-oriented research.[6] Several studies have already shown that culture has an important impact on user experience. For example, perceived uncertainty influences acceptance of technology, but uncertainty avoidance levels differ between countries (e.g. Belgium and Germany) and require

communication alignment.[7,8] An empirically supported model shows that uncertainty avoidance culture influences perceived ease of use and, consequently, behavioural intention to use information systems.[9] In addition to uncertainty avoidance, user preferences for interactive technology have also been related to individualism/collectivism and contextuality in a study performed in Korea, Japan and Finland.[10] Comparisons in usability preferences for software product categories between a German and an Indonesian sample have shown that whereas both nationalities found pragmatic usability features (task-related functions) similarly important, Indonesian participants found hedonic usability features (emotional experience) more important than their German counterparts.[4] User expectations and experience of interactive technologies can additionally be influenced by individual differences, such as the end users' gender or age.[11–14]

As cultural differences can influence user experience and acceptance of technology, innovations should be tested in individuals with varying cultural background to increase their potential uptake and impact. However, cultural differences and individual differences could also influence data collection and be confounding variables for study outcomes. Characteristics that can be associated with culture (e.g. socioeconomic or educational status) could threaten the validity and reliability of cross-cultural studies.[5] Moreover, methodological approaches that work well in one country or context might not necessarily be appropriate in a different context. Nevertheless, research on the influence of cultural and individual differences on study design and methodology of user-centred and living lab research is very limited.

Group sessions (e.g. co-creation/co-designing sessions, focus groups) are commonly used in living lab research since they are considered to be a culturally sensitive methodology in which group interaction is key to gaining insight into diverging and converging opinions.[15,16] However, group dynamics could also hinder data collection in some conditions. Not all participants might actively contribute to the discussion, which could be due to the social context and to the characteristics of the peers that are present.[16] Individuals with certain personality traits or social standing can (unintendedly) intimidate group members and hereby influence the outcomes of the session. Guidelines recommend that participants of group sessions are homogenous in personal characteristics and background, but studies investigating the effect of heterogeneity on outcomes in group sessions are sparse.[15] Additionally, it is not always feasible to cluster individuals based on all potentially relevant characteristics, such as gender, age, ethnicity and socioeconomic status (SES), the latter of which is often measured as a combination of education, income and occupation. A study investigating ethnical diversity in focus groups observed that more heterogeneous groups experienced more difficulty than homogenous groups when discussing ethnic and cultural differences.[15] However, no effects were found on other topics (i.e. being a caregiver). Combining individuals from different age groups (children and older adults) in a co-design study can have implications for the preferred methodology (e.g. using sticky notes or making drawings) and the organisation of the sessions (e.g. group size, timing and activities during breaks).[17] Older individuals could also be considered more important figures, especially in non-Western cultures.[18] Therefore, younger individuals might not consider it appropriate to voice differing opinions, which is problematic for unbiased data collection. Gender could have a similar effect in some contexts.[18]

Digital health applications and interactive technologies increasingly allow organisations to transcend national boundaries and expand the provision of tools and services to communities across the world. Cross-border user experience research, often supported by living lab organisations, can help to facilitate innovation uptake. This research assesses the needs of individuals from different social, environmental and cultural contexts in relation to these innovations, but often proves challenging. Cross-cultural and individual differences do not only influence how innovations are perceived, but also affect how studies are conducted and which conclusions can be drawn from them.

The use of standardized protocols for recruitment and study execution of cross-border research might therefore not always provide the optimal results for each local context. To address the lack of research on this topic, the current study investigates which regional differences can influence end-user participation in user-centred research performed by living labs across the world. The aim is to investigate across different countries: (1) the recruitment strategies that are being used and are considered effective by living lab organisations; (2) whether user contribution to research is influenced by gender, age, SES and professional background in group contexts (e.g. focus groups or group co-designing sessions) and in individual settings (e.g. interviews, human factors studies); (3) whether living labs deploy strategies to increase equal representation and contribution; and (4) which role the moderator takes up.

Materials and methods

Recruitment

Organisations performing living lab research, especially those working in the area of health and the silver economy, were invited to complete an online survey, through personally addressed e-mails, social media and through networks, including the European Network of Living Labs (ENoLL). Although we strived for equal representation of different regions across the world, living labs are less common and more difficult to reach outside of Europe. Data was collected between December 2018 and April 2019. All participants provided informed consent.

Survey

A survey assessing cross-cultural differences in the participation of end users in living lab research was designed. Firstly, the survey inquired about the recruitment process in the specific region of the participating living lab. Secondly, local differences in study participation depending on gender, age, professional background and SES were assessed. Finally, the participants reported on the use of inclusion strategies and the role of the moderator and reflected on potential cross-cultural differences. The survey consisted of multiple choice and open-ended questions. Completing the survey took about 35 min.

Analyses

Frequency analyses were used to compare the responses of different regions. Additionally, thematic qualitative analyses were used to gain more in-depth insight into cross-cultural differences.

Results

Description of living labs

In total, 36 living labs of 20 countries participated in the survey (Table 1). The majority of these living labs are situated in European countries ($n=28$). No living labs from Africa and Eastern Europe could be included. Most living labs report a specific interest in the area of Health and Care and the Silver Economy ($n=21$) or in IT-driven solutions ($n=7$). All living labs, apart from one Danish living lab, completed the entire survey. One living lab identifies as being both French and Spanish. Its inputs are, therefore, included in both the Western and Southern European regions. Due to a small sample size, findings in countries outside of Europe should be interpreted with care.

Table 1. Participating countries organised according to the United Nations Geoscheme of geographical regions of the world.

Region	Subregion	Country	Participating living labs
Europe	Western Europe	Austria	1
		Belgium	3
		France	5[a]
		Germany	1
		Switzerland	1
		Netherlands	4
	Northern Europe	Denmark	1
		Finland	2
		Ireland	1
		United Kingdom	5
	Southern Europe	Italy	2
		Spain	3[a]
Asia	Eastern Asia	China	1
		Taiwan	1
	Southern Asia	India	1
	Western Asia	Turkey	1
Americas	Central America	México	1
	Northern America	Canada	1
	Southern America	Colombia	1
Oceania	Australia and New Zealand	Australia	1

[a]One living lab indicated that it was operational in both Spain and France.

All living labs perform group sessions (e.g. co-creation sessions or focus groups). On average, they organize 26 of such sessions annually ($M=25.5$ SD$=44.94$), however this ranges from 1 session to about 225 sessions per living lab per year. The living labs perform about 38 individual sessions (e.g. interviews, human factors studies) annually ($M=38.45$, SD$=73.77$). Again, differences between labs are large with two living labs performing no individual sessions at all and others performing up to 300 sessions per year. Additionally, living labs perform other activities, such as stakeholder meetings ($M=17.09$, SD$=16.47$ annually), survey studies ($M=7.59$, SD$=8.78$ annually) and other activities, for instance innovation labs, community building, business model development, live sessions and boot camps. There is a large range in the number of participants that are being included on a yearly basis. Most living labs include between 10 and 500 participants ($M=156.76$, SD$=126.14$, $n=27$). Six living labs include more than 500 participants each year, specifically in Colombia ($n=1000$ participants), UK ($n=1300$ participants and $n=6892$ participants), Finland ($n=2000$ participants), Belgium ($n=5000$ participants) and Canada ($n=15{,}000$ participants).

Recruitment of participants

Participating living labs were asked to report which communication channels they use for recruitment and which mode of recruitment is most effective in their region (Figure 1). Living labs most commonly recruit through other organisations, such as patient organisations, professional associations, or collaborating partners and developers. It is the most effective mode of recruitment

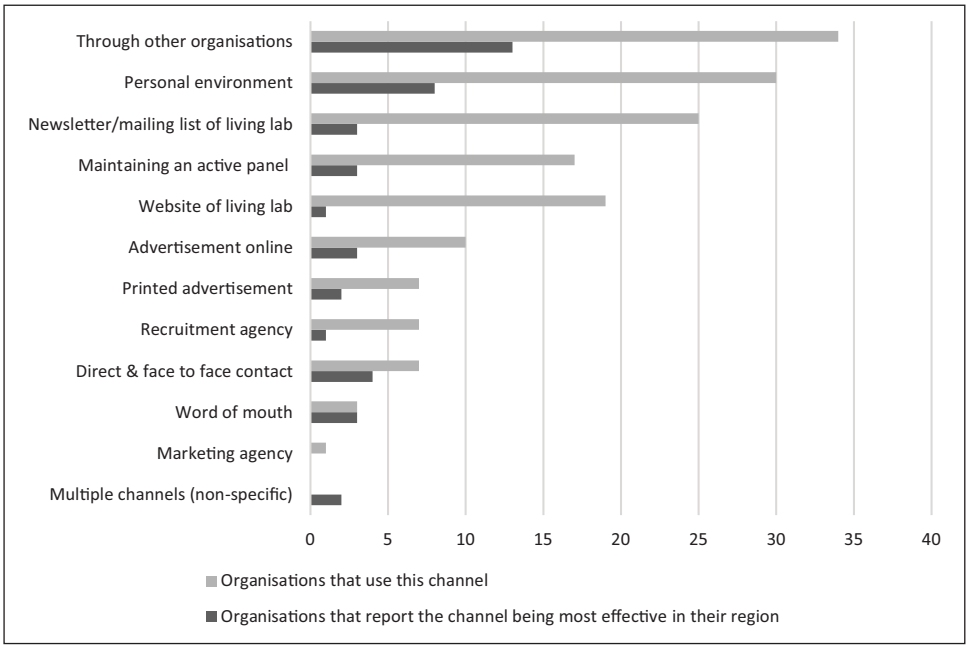

Figure 1. Frequencies of the communication channels that are begin used to recruit participants and the communication channels that are reported to be most effective in a region. Living labs were able to report multiple communication channels.

according to 13 living labs, mostly because these other organisations have an existing relationship with – as well as existing knowledge of – the target group. Additionally, recruitment through the work-related or through the personal environment of the living lab (e.g. previous contacts, staff and patients of the hospital) is regularly used and eight living labs find it an effective strategy. This approach has the benefit that a relationship with end users already exists, which contributes to availability and motivation. While mailing lists and panels are common ways of recruitment, they are rarely the preferred means. Few regional differences exist with regard to the communication channels that are being used or preferred. However, online advertisement (e.g. on fora or social media) is solely practised in Northern Europe (5/9 living labs) and in Western Europe (by 5/14 living labs).

On average, attrition rate is around 15% in the participating living labs ($M = 14.88$, SD = 10.31). Estimates are somewhat lower in Northern and Central America (8% and 2% respectively) and Australia (5%), as compared to European (16%) or Asian countries (16%). Categories for motivation for participation are defined by thematic analysis. The values presented in Table 2 indicate the number of living labs reporting this motivational principle to be present. Multiple driving principles could be reported per living lab. In general, participation in living lab research seems to be most strongly driven by an intrinsic motivation for personal reward, such as gaining appreciation and knowledge. Other motivating factors include gaining material rewards, contributing to helping others or the society, being interested in the specific product or application, or having social contact. Results suggest that personal reward is predominantly important in Europe and Australia, while external (monetary) reward is more important in Central America and Eastern Asia (Table 2).

Table 2. Motivation for participation. The five middle columns give an overview of the number of living labs reporting different principles, which motivate participants in their research studies. The final column on the right represents the extent to which an external reward is needed to motivate participants on a scale from 0 (not needed at all) to 10 (participation solely for reward).

Region	Reported motivating principles					External reward needed
	Personal reward	External reward	Contribution	Interest in innovation	Social contact	Mean *(SD)*
Central America		1				8.00
Northern America[a]						5.00
Southern America		1		1		3.00
Eastern Asia		2	1	1		8.00 *(1.41)*
Southern Asia			1	1		5.00
Western Asia	1	1			1	1.00
Australia	1		1			3.00
Northern Europe	6	6	3	5	1	3.67 *(1.94)*
Southern Europe	3		1	2		2.00 *(2.00)*
Western Europe	9	5	6	3	2	4.73 (*2.69*)
All living labs	20	16	13	12[b]	4	3.83[b] (*2.40*)

[a]The participating living lab (from Canada) did not report specific motivating factors.
[b]While the input of the French-Spanish living lab was included in the results of both southern and Western Europe, it was only counted once in the entire sample.

Turkey (Western Asia) appears to be situated more closely to the European values in the field of motivating factors. Differences between specific countries within one region are limited.

Living labs report that target populations and study designs relate to whether external rewards are necessary for participation. External rewards appear more important for professionals (with limited time available) or for individuals recruited by recruitment agencies. Participants with an intellectual interest in the topic and patients who can gain from the innovation have a lower need for external motivators. While a Dutch living lab experiences that older people are more intrinsically motivated (which they suggested could be because they have more time for participation than their younger counterparts do), a living lab from the United Kingdom (UK) reports that reimbursement of costs is relevant for the elderly. Apart from cross-cultural differences, external factors can also have implications for remunerations. Studies that require more investment from participants (in time or due to experiencing some discomfort) are more likely to need external rewards. Additionally, rewards can be influenced by project budgets and whether the innovation is for public design as opposed to a private enterprise or academic research.

Group selection

Many living lab activities consist of group sessions (e.g. focus group, co-creation sessions). Group sizes can vary depending on the innovation of interest, target population and study design. However, living labs indicate that they generally consist of about 11 participants ($M = 10.54$, $SD = 5.68$). These groups can contain individuals differing in gender, age, professional status and SES. Figure 2 provides an overview to what extent living labs indicate that these factors would

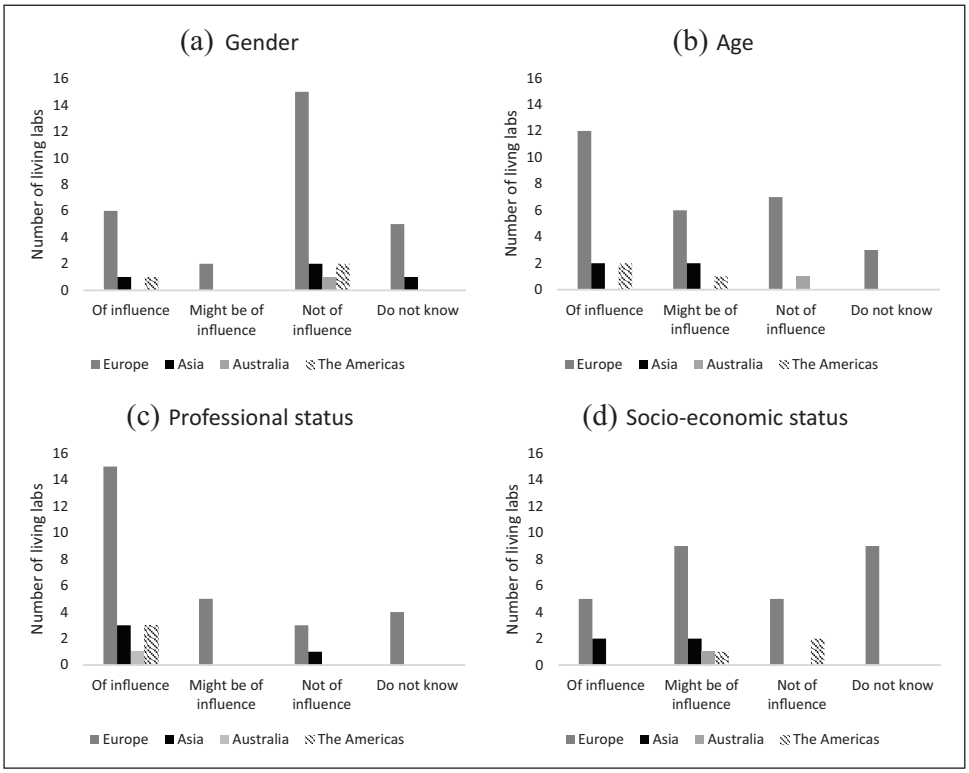

Figure 2. These graphs represent to what extent living labs believe personal characteristics, specifically gender (panel a), age (panel b), professional status (panel c), and socio-economic status (panel d), would influence active contribution in living lab research.

influence contribution in living lab research. Contribution was defined as actively collaborating in the process, providing input and formulating ideas in the session.

More than half of living labs ($n=20$) report that they do not consider gender to be of influence to study contribution, while about a quarter does believe it could have an impact ($n=8$). Gender is mainly reported to have an impact in Austria, India, Mexico and the UK. However, only India and one Italian living lab organize separate sessions for male and female participants. Living labs were asked to estimate the contribution of male and female participants in three conditions: mixed gender group session, separate group sessions per gender, and individual sessions. Although living labs find it difficult to make this assessment, the majority of labs believes that both genders contribute evenly in all three conditions (mixed: $n=19$; separate: $n=13$; individual: $n=22$). The remaining living labs mostly report that female participants contribute somewhat to a lot more actively (mixed: $n=5$; separate: $n=7$; individual: $n=5$). Three living labs (from Austria, Germany and The UK) report that male participants would contribute more actively in mixed group sessions, but that organizing separate group sessions would results in increased contribution from female participants ($n=2$) or equal contribution of both genders ($n=1$).

While age is not considered to have an impact on contributions to living lab research according to the majority of living labs in France and Australia, most living labs from the other countries do believe that age could be of influence on living lab research. Again, assessing contribution depending on age is considered difficult (do not know: $n=12$ to $n=13$ in the three conditions). The

majority of labs believe that contribution is not influenced by age in all three conditions (mixed: $n=12$; separate: $n=18$; individual: $n=19$). About half of the remaining living labs report that older participants contribute somewhat to a lot more actively (mixed: $n=6$; separate: $n=3$; individual: $n=3$) while the other half beliefs that younger participants contribute somewhat to a lot more actively (mixed: $n=5$; separate: $n=3$; individual: $n=2$). In Turkey (Western Asia), older participants are a lot more active in mixed group sessions, while older and younger participants contribute equally when separated by age in group or individual sessions. Different age groups are consequently always included in separate sessions in this country. Seven other living labs (from Austria, China, India, Italy, Mexico, Spain/France and the UK) also try to organise separate sessions for different age groups when possible. The majority of European labs include different age groups in one session. Some labs are also specifically focused on research in certain age groups (e.g. elderly) and therefore already have a homogeneous sample in relation to age.

The vast majority of living labs report that professional status, which refers to whether participants are end users/patients or professionals (e.g. hospital staff), definitely ($n=22$) or potentially ($n=5$) influences study contribution. Nevertheless, only three living labs (all European) try to organise separate sessions for participants with a different background, while 22 living labs include them in the same session. Overall, most living labs consider professionals and end users to contribute evenly in mixed group sessions ($n=14$), separate group sessions ($n=14$), and individual sessions ($n=13$). However, there were also many living labs that were not sure how professional status influenced the contribution in these different sessions ($n=9$, $n=13$ and $n=11$ of the sample, respectively). Of the living labs that did observe a difference in contribution, it is mostly the case that professionals contribute somewhat to a lot more actively than end users do ($n=10$, $n=6$ and $n=8$ of the sample, respectively).

Finally, estimating the influence of SES can be more difficult as compared to gender and age, since it is harder to observe and not always documented or even disclosed. Participants with a high SES have a good income and perform at a high educational/professional level. Participants with high and low SES are equally likely to participate in research according to 14 living labs. The majority of Belgian and Dutch living labs and about half of living labs from the UK believe individuals with high SES are more likely to participate as compared to low SES individuals. On the other hand, a Turkish, Colombian and one other UK living lab indicate that individuals with low SES are more likely to participate. The remaining living labs were not sure about the representation of SES in their samples. Opinions were also divided regarding the influence of SES on study contribution, with most participants reporting that it could potentially have an impact (Figure 2). SES is estimated to have an impact on contribution by seven living labs, representing the majority of living labs from the UK, Taiwan and Turkey as well as half of the Dutch living labs. Seven other living labs, representing Mexico, Colombia, Finland, Germany, Ireland, Italy and the UK, do not generally believe SES to have an impact on contribution in the sessions. Participants with different SES are often represented in one group, with only three living labs (in Belgium, China and the Netherlands) trying to organize separate sessions if possible. Participants with differing SES are mostly included in one group due to the fact that SES is often not known (beforehand) or not of interest for the study. The majority of participants were not sure how SES influences the contribution in groups with mixed SES ($n=19$), separate groups ($n=23$) or individual sessions ($n=21$). All remaining living labs report equal contribution or more contribution of high SES participants (representing living labs from Belgium, China, Turkey, the Netherlands and the UK).

Living labs were able to report other individual characteristics that could influence participation or contribution to living lab research. Five labs indicated that geographical living situation is of importance. Not living nearby the living lab and/or lacking mobility impedes participation and environmental characteristics (e.g. living in a town vs rural living) could also influence participation.

Table 3. Strategies to promote different individuals (or groups) to be equally represented in the output of a session. Strategies are based on thematic analyses.

Strategy	Number of living labs applying strategy
Directly and personally addressing individual participants	10
Combining different modes of communication: writing, verbal communication, constructing models, etc.	6
Implementation of good facilitation/moderation methods	5
Temporarily splitting the group up into smaller groups or duos	5
Doing a round of the table	4
Increasing participants' comfort: selection of room, planning breaks, using icebreakers and games, etc.	4
Giving clear instructions that everybody needs to be heard	2
Techniques of service design	2
Appropriate language and communication skills	2
Careful preparation of sessions according to needs	2
Using tools to construct a non-hierarchical environment	1
Promoting trust (by including a psychologist)	1

Secondly, the match between the product and participant (in terms of interest, experience, but also having the feeling that they can have an impact) was deemed important by five living labs. Health can influence participation in two ways. On the one hand, health problems and disability could lower participation rate (through lack of access or lack of ability to interact with innovations; $n=3$). On the other hand, the health situation could increase the relevance and lead to stronger contribution ($n=1$). The economic situation could also have an impact ($n=3$), both in relation to availability for research (higher workload means lower availability) as well as when it comes to attitude (e.g. more negativity in unemployed participants). Next, ethnicity appears to be important in some regions. In the UK, an underrepresentation was observed of individuals of black and minority ethnicity ($n=2$). Having a migratory background is reported to have an impact in Turkey. Relatedly, language (e.g. not being a native speaker) can influence contribution in the sessions ($n=2$). Other factors influencing participation in research or contribution to the sessions are personality characteristics such as technological competence ($n=3$), extraversion ($n=2$), position in a group (in studies with employees of a company; $n=2$), previous living lab experiences ($n=1$) and early adopters being overrepresented in research ($n=1$).

Use of strategies

When living labs experience that they are not reaching certain participant groups in the recruitment process or experience differences in the contribution of individuals in sessions, they can use different strategies to increase equal representation in contribution. In the recruitment process, the majority of living labs from all regions sometimes ($n=22$) or always ($n=5$) apply strategies to reach populations that will otherwise be less likely to be represented in the sample. The most common way to reach these populations is through intermediary organisations or individuals ($n=9$, mostly used in Belgium, the Netherlands and the UK), by contacting individuals that the labs have previously worked with or are in their database ($n=3$, used in France and Turkey), or by carefully selecting one or more communication channels to reach the targeted sample ($n=4$). Other strategies consist of following up on recruitment and adjusting strategies to target underrepresented groups ($n=2$), being embedded in a disadvantaged community ($n=1$) or

optimizing the practical circumstances, that is, easy-to-reach venue, time outside or rush hour, ability to bring carer ($n = 1$).

During group sessions, almost all living labs sometimes ($n = 16$) or always ($n = 16$) use specific strategies to make sure that all participants are equally involved and their opinions are equally heard. Table 3 gives an overview of different strategies. The living labs often combine multiple strategies. The most commonly used strategies consist of directly addressing individuals, using different modes of communication within sessions (e.g. writing individually on sticky notes combined with oral group discussions), splitting up into smaller groups, and having a skilled facilitator to conduct the sessions.

Moderator selection and involvement

As mentioned above, a moderator (also called facilitator) has a large impact on the course of a session. However, there could be cross-cultural differences in how directive a moderator should be for optimal outcome. There is a large consensus that the role of a moderator should be somewhat flexible, depending on the characteristics of the product, study and sample. A moderator should generally be able to create an environment that puts participants at ease, but also ensure that all research questions are answered. That being said, there are some local differences. Predominantly in the UK, Netherlands, Germany, Colombia, Switzerland and Mexico, the moderator is seen as a facilitator and participants should take the lead. The Indian living lab goes even further by calling the moderator a 'co-participant'. However, living labs from Taiwan, Italy, Turkey and Ireland believe the moderator should be a director of the session and guard the process, a role that is somewhat more authoritative.

More than half of living labs regularly ($n = 15$) or sometimes ($n = 4$) use diverse moderators in different studies or sessions. Moderator selection occurs mainly based on the type of session or research, which might require specific skills or knowledge. Additionally, it could vary based on group characteristics (such as age) or practical reasons (such as availability). The majority of living labs ($n = 21$) report that the sample does not influence which moderator is being used. Four living labs (from Belgium, China, Italy and India) try to match the moderator with the sample (e.g. a young moderator with a young sample), while two living labs (from Colombia and the UK) try to use a complementary moderator (e.g. an older moderator with a young sample). Twelve living labs consistently use the same moderator and report the following reasons: practical constraints (e.g. not having other moderators available), the assumption that a moderator should have sufficient skills to moderate all kinds of sessions, and using the same moderator to build a relationship of trust with the participants.

Other international differences

When living labs were asked whether participants of their own region differed from those in other regions of the world, eight living labs reported differences in culture that were not further specified (Mexico, Colombia, Ireland, the UK, Italy ($n = 2$), Spain ($n = 2$), Switzerland and Spain/France). Additionally, some other specific participant characteristics were reported. Two Dutch living labs reported that their participants are often more direct in their input in the sessions. One of these labs also reported that Dutch people are more likely to adopt new innovations. The two Finnish living labs report greater commitment to research in their country, possibly due to greater equality between citizens. A difference between Australia and the largest part of Europe is that there is more rural living (and the associated problems) in Australia. In Austria, the urban/rural structure is reported to be different from other countries (without further specification). In the UK, greater

privacy concerns have been reported ($n = 1$), as well as differences in the use of technology in age groups ($n = 1$; not further specified). Apart from these differences between countries in participant characteristics, the location and approach of the specific living lab could influence how individuals behave in sessions. A Belgian living lab reported that their panel approach results in the development of a personal bond with participants. A German living lab reported that due to their location in a university city, they have a strong representation of individuals high in SES and educational level.

Participating living labs also reported on other cultural differences that were not necessarily important in their own region, but could be relevant in other parts of the world. Firstly, policies and business models could influence the input in living lab research. This specifically concerns differences in the social welfare system and how secure individuals consequently feel, differences in corporate structure (hierarchy) and the (political/historical) openness of society and related openness towards innovation. Other differences could be based on culture and religion, migration or the geographical location of individuals (within countries). Secondly, potentially important cross-cultural differences consist of health, personal and professional beliefs and the existence of trust between participants and researchers. Anecdotal evidence of a Dutch living lab also hints to some underlying cross-cultural differences. They experienced that, as compared to the direct, open and critical stance of participants in the Netherlands, participants in other countries are more polite and hold back harsh criticisms (e.g. in the UK) or appear to be more sensitive to social desirability (e.g. in Taiwan). However, these differences were not reported by the other respective countries.

Discussion

In recent years, new and global markets have become more easily accessible for organisations that develop innovative technological solutions to existing challenges. However, to facilitate cross-border implementation, organisations and institutions should invest in international collaboration and user-centred research. Cross-border research can deliver relevant information for developers and allow researchers and living labs to exchange best practices and harmonize ideas.[3] Cross-cultural differences (e.g. uncertainty avoidance, gender roles) are of interest for developers as they influence user experience and acceptance of innovations, but they can also be a confounding factor for data collection. Participants from different regions might require different recruitment, grouping and support strategies, which might not always be possible in fully standardized research protocols. The current study aimed to investigate living labs' perception of differences in the participation of end users from different regions. The majority of these living labs have a specific specialisation in health and care, the silver economy, or digital technologies. Results show that regional differences are reported in terms of participants' motivation for participation and the impact of gender, age, professional status and SES on participants' contribution. Additionally, regional differences also seem to influence whether a moderator should be a facilitator or a more dominant guide of the process. Implementing well-chosen strategies for recruitment, making groups and supporting equal contribution in sessions could improve the quality of international user-centred research, while still maintaining sufficient standardisation.

The recruitment process appears to be very similar in different regions, with the preferred channels consisting of recruitment through other organisations or using the existing network of the living labs. Participation of end users and stakeholders is expected to be mostly driven by intrinsic motivation, although gaining material rewards, contributing by helping others or the society and being interested in the specific product or application are also common. While personal reward might be sufficient to include participants in European, Australian and Turkish living labs, recruitment in the Americas and Asia is more likely to require some form of reimbursement. A previous

study in a Northern American sample showed that intrinsic motivation, more specifically altruism, was an important driver for participation by healthy individuals in a household exposure study.[19] However, this study did not assess external reward and was conducted in the United States, so a direct comparison with the current findings is not possible. Researchers should be aware that offering financial compensation might influence participants' contribution and that there is some discussion regarding the ethics of offering financial rewards, depending on the nature of the study (e.g. medical research) and relationship between the researchers and participants.[19,20] Apart from regional differences, the need for reimbursement might depend on participant characteristics (e.g. professionals vs patients or level of interest), required participant investment, and the innovation itself.

Group sessions are valuable tools in user-centred research since interactions can help people voice their ideas and expose contradicting views, leading to more in-depth information.[16] Creating a non-threatening and non-judgemental environment, where opinions and experiences can be discussed openly, is key to a successful group session in living lab research.[16] However, differing social norms and personal status related to individual characteristics could imply that the group composition needed for open communication is dissimilar between countries. Different regions show varying levels of awareness of the influence of individual characteristics on research contribution. A first relevant individual characteristic is gender, which is reported to have an influence on contribution in about a quarter of participating living labs. However, only one living lab organizes separate group sessions for male and female participants. If living labs report non-equal contribution depending on gender, this is mostly reflected in female participants contributing more to the sessions. However, the contribution of female participants is stated to be hampered by the presence of male participants in group sessions in some European living labs. Although no African living labs could be included, previous research in Tanzania suggests that all-women groups are better able to collaborate (possibly due to gender-specific social identities) as compared to mixed or all-men groups.[21] Secondly, a vast majority of living labs believed age to have an effect on living lab contribution. Although European living labs mostly combine different age groups in one session, constructing separate groups depending on age does appear recommended in multiple countries in and outside of Europe. This is in line with previous research stating that differences in relation to age could influence data collection and might call for the use of different methods.[17,18]

Professional status can also influence contribution according to the vast majority of participating living labs. Results suggest that professionals might contribute more than patients. Nevertheless, participants with a different professional background are mostly included in the same session. This could be problematic because differences in professional background can be associated with relationships with a difference in power (e.g. patient and healthcare professional or employee and manager). While participants might be more likely to follow and support the ideas of certain power-holders, these power-holders can sometimes be more focused on the 'self'.[22] This could not only make discussions more difficult but also implicate that research findings might not present an optimal solution for all stakeholders. Relatedly, SES is a personal characteristic that might not always be obvious for living labs, but that could nonetheless influence contribution in user-centred research. While most living labs report that participants with differing SES participate equally in their research, some participating living labs do report that high SES individuals are more likely to participate. Several living labs also observed that high SES participants contribute more actively to sessions than their low SES counterparts do. However, only few living labs try to organize separate sessions depending on SES.

The findings suggest that organizing separate group sessions and using specific strategies to ensure equal representation of every individual in the outcome could be warranted. Participating living labs provided several useful strategies to better meet the needs of individuals with diverse background

characteristics. Regularly implemented recruitment strategies for broader reach consist of using intermediary organisations, using known participants, and combining multiple communication channels (as well as evaluating recruitment along the way). In line with Halcomb et al.[18] who state that cross-cultural differences could also affect the preferred venue or procedures, one UK living lab optimizes practical circumstances (e.g. time and venue) to maximize the potential availability and minimize mobility issues. While the current study does not go into the appropriateness of specific methodologies or study aspects, previous research has suggested that practical circumstances, such as informed consent procedures, cannot be directly transferred between different countries.[23]

Nearly all living labs regularly use specific strategies to promote equal contribution in sessions, such as directly addressing individuals, combining different communication modalities and having a skilled moderator. However, how a 'skilled moderator' should conduct sessions can differ between countries. A potential benefit of cross-border living lab collaboration as opposed to other, more traditional, cross-cultural research is that each living lab executes the study in its own region. Local moderators and researchers speak the language and are aware of preferred communication styles. A moderator should introduce the topic, encourage discussion and interaction and guide the conversation.[16] Participating living labs generally agree that a moderator should be able to create an open and welcoming environment, but also ensure that the procedures are being followed. Nevertheless, some living labs recommend a more facilitating stance while a more authoritative stance might be required in others. Sessions can be led by different moderators depending on the type of research or group characteristics, but consistently using one well-trained moderator could also have benefits (e.g. building a relationship of trust). Nevertheless, characteristics of the moderator, such as gender, can influence discussions of certain topics.[16]

Living labs also reported some other interesting local specificities and factors of interest. Participants might differ from other regions by being more active in sessions (e.g. in Finland), being more direct (e.g. in the Netherlands), having a stronger rural background (e.g. in Australia), or being more sensitive to privacy issues (e.g. in the UK). Ethnicity and culture were also reported as relevant characteristics to include. As previously shown, culture and ethnicity are indeed important, however their impact could depend on the topic of interest and they are associated with other concepts such as language and SES.[5,16] Additionally, ethnicity might not always be clear to the conductors of the study since it refers to how people identify themselves. Due to the broad definition of these concepts and the difficulty to measure and compare them in international regions, it was not possible to systematically include ethnicity in the current study. In accordance with previous research, language was also suggested as a factor of interest.[18,24] Other influencing factors that might be of importance for participation and contribution in living lab research could be policies and business models (e.g. the welfare system), religion, geographical living situation, health status, economic situation, personality characteristics, technological competence, position in a group and the match between innovation and participant.

The effect of cross-cultural differences does not receive sufficient attention in user-centred research in health informatics and living lab practice. In the current survey study, some living labs reported that a certain characteristic was not important for their research and that they mainly focused recruiting participants relevant for the innovations of interest. However, while cross-cultural differences might not always be deemed directly relevant to the innovation of interest, they will be important for the process of data collection. The majority of living labs indeed report that factors, such as gender, age, professional status, SES and cultural background, can influence participation in living lab research and group dynamics. Without the necessary methodological considerations, the results of a study might not be representative of the whole population of a region or might not even reflect the views of all individuals present in a session. Whereas it is not possible to always make separate groups depending on all relevant characteristics, being aware of individual differences and

consciously implementing strategies to promote equal representations as much as possible can improve user-centred research. Increases in globalisation of markets as well as (international) living lab research hold challenges but also opportunities to advance the quality of cross-cultural user-centred research. New ecosystems and projects (e.g. the VITALISE European Union Horizon 2020 project) contribute to harmonizing research procedures and exchanging expertise between international living labs, which will lead to better research protocols and products and services that are able tackle global challenges but have been built to suit the needs of each individual end user.

Several limitations require discussion. Despite recruitment efforts, the sample of the current study consists predominantly of European living labs. Many countries are only represented by a single living lab, which implies that findings at a country level should be interpreted with care, especially outside of Europe. This preponderance of European centres is – at least in part – a reflection of the active promotion of the European Union of living labs and the importance of end-user involvement. The results should therefore be replicated in larger samples in future research. In countries where only one living lab participated, it is also not possible to differentiate between the potential impact of geographical region or the procedures and methodology of specific living labs. Additionally, the current study only relied on self-report data. Future research should collect data on actual recruitment of participants and contribution in international user-centred research depending on individual characteristics.

The rise in living labs allows organisations to rely on a specialised network of international research partners to assess end-user needs and preferences and report on local implementation requirements. The current study shows that living labs around the world that perform research into health informatics and other technological innovations report many commonalities when it comes to implemented methods, and even reported individual differences, in their samples. However, regional differences are also described and could influence study findings. Protocols of cross-border studies should be of sufficient methodological quality and allow comparisons (through standardisation). However, potentially relevant differences in the target populations should also be taken into account in the study design. Study protocols could suggest good practice strategies for promoting equal representation, such as directly addressing individuals and using multiple communication modalities within one session, independently of the included regions. Additionally, when including certain regions or innovations related to sensitive topics (see also Liamputtong[16]), it might be advisable to separate individuals in different groups based on individual characteristics. When designing research methods for end-user participation, local differences and sensitivities should be taken into account. At the very least, cross-cultural differences should be a topic of discussion and exchange in cross-border collaborations.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon request.

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