This paper was presented at the XXXIV ISPIM Innovation Conference, held in Ljubljana, Slovenia on 04 June to 07 June 2023. Editors: Iain Bitran, Leandro Bitetti, Steffen Conn, Jessica Fishburn, Paavo Ritala, Marko Torkkeli & Jialei Yang. ISBN 978-952-65069-3-7.

Problems and Answers When Organising International Innovation Contests in Cross-border Collaboration

Mikael Johnsson*

Mälardalen University, Box 325, 631 05 Eskilstuna, Sweden.
E-mail: mikael.johnsson@mdu.se

Ioana Stefan

Mälardalen University, Box 325, 631 05 Eskilstuna, Sweden.
E-mail: ioana.stefan@mdu.se

Jakob Ilg

CyberForum e.V., Haid-und-Neu-Strasse 18, 761 31 Karlsruhe, Germany.
E-mail: ilg@cyberforum.de

Reesi Lepa

Civitta Eesti, Riia 24a, 51010 Tartu, Estonia.
E-mail: reesi.lepa@civitta.com

* Corresponding author

Abstract: In this study, we build on prior research to explore problems arising and answers attempted when an international innovation contest (IC) is organised by multiple organisations in cross-border collaboration. A Consortium involving ten science parks and one university developed a multistage IC, consisting of four phases: exploration, ideation, implementation and international market launch. This study focuses on the first two phases. The Consortium attracted participation from 300 challenge owners from twelve countries, generating 559 proposals by 318 SMEs from 36 countries. The empirical setting is explored in great detail. Data were collected through open-ended written questionnaires and field notes. Identified problems were related to four themes: collaboration, coordination, communication, and commitment. These could be further divided into internal and external problems. Practical implications and future research avenues are suggested.

Keywords: Innovation management; innovation contest; environment; innovation challenge; cross-border; collaboration; coordination; communication; commitment.

This paper was presented at the XXXIV ISPIM Innovation Conference, held in Ljubljana, Slovenia on 04 June to 07 June 2023. Editors: Iain Bitran, Leandro Bitetti, Steffen Conn, Jessica Fishburn, Paavo Ritala, Marko Torkkeli & Jialei Yang. ISBN 978-952-65069-3-7.

1 Problem

The global trend of increasing urbanisation is generating escalating urban challenges (UC) related to, for instance, the built environment, the physical health of citizens, or issues concerning the circular economy (Almenar *et al.*, 2021). Further complex problems related to issues such as healthcare and food supply are likely to arise in urban agglomerations. Such challenges need to be addressed swiftly and effectively given the increasing urban population – at present 55% of the earth's population lives in cities; by 2050 the proportion is estimated to be about 65%*.

To solve these problems, innovative solutions would be required – therefore, innovation contests (IC) may be a way of solving challenges in the interest of the greater good (Haller *et al.*, 2011). ICs go back several hundred years and are known as tools to inspire innovation (Adamczyk et al., 2012). Urban societal challenges are increasingly tackled with the help of ICs, as was the case during the COVID-19 pandemic (Bertello *et al.*, 2022). However, because of the complexity of urban societal challenges, finding solutions for them can be regarded as an international matter to be tackled by multiple organisations in cross-border collaboration. Collaborative innovation is thus used as an enabler for the successful addressing of grand challenges (McGahan *et al.*, 2021). We therefore argue that there is a need to study ICs managed by multiple organisations in cross-border collaboration, where the results benefit both the research community and practitioners.

The aim of the present study is to gain knowledge about difficulties that might occur when multiple organisations manage ICs intended to solve urban environmental challenges in cross-border collaboration.

2 Current understanding

Innovation contests – organisation and results/outcome

ICs are arranged in various ways, with the problem seeking solution usually provided by an organisation (challenge owner) and the winner or winners awarded a prize.

ICs are generally structured as a process to be completed within a limited time (Gama, 2017) and usually divided into three steps: pre-contest (including the planning of the IC), the contest, and the post-contest period which could last from a couple of hours to several months or years (Hjalmarsson *et al.*, 2017). ICs may also vary in the number of phases, with only the most promising solutions advancing through the phases (Terwiesch & Ulrich, 2009), which facilitates investment in the most promising solutions. ICs may also focus on various themes or perspectives – for instance, in their systematic review, Adamczyk et al. (2012) found ICs that belonging to five different categories: economic, and management were so-called meta-perspectives, while the remaining three categories focused on education, innovation and sustainability. The former meta-perspective deals with economic models for ICs, while the latter relates to management and organizing of ICs (Adamczyk *et al.*, 2012). The other three categories concern somewhat different target groups, i.e. education ICs aim to motivate students and promote learning, innovation-focused ICs are oriented towards the promotion of new products and services, while sustainability ICs

boost sustainability-related challenges (Adamczyk *et al.*, 2012). The management meta-perspective as well as the sustainability-focus are central for this study.

From prior research we know a great deal about ICs. For example, large and complex challenges are unlikely to suit small ICs (van Winden & Carvalho, 2019), as they don't attract as many participants as large ICs do. Therefore, large ICs are more likely to generate better solutions (Desouza, 2012). On the other hand, large ICs are difficult to manage (Desouza, 2012). At the same time, with large ICs the bureaucracy increases, and before the most promising solutions are chosen, the organisers need to be very careful (van Winden & Carvalho, 2019). Less explored issues related to ICs in prior research, according to Adamczyk et al. (2012), concern e.g. the evaluation of ideas, as well as (organisational) structures to support organizing ICs and designing co-creation spaces to boost IC outcomes

Difficulties with ICs

Difficulties related to ICs have been predominantly studied at organisational level. For instance, prior research identifies obstacles concerning idea selection, timing, as well as implementation problems (see e.g. Wikhamn, 2013). Further general problems of ICs are, for example, limited results (DiSalvo *et al.*, 2014) and the difficulty of solving large-scale problems within a limited time (Pihlajamaa & Merisalo, 2021)As IC topics become more intricate and complex, it might be difficult for a single organisation to arrange contests and collect a sufficient number of quality proposals (Mack & Landau, 2020). Hence, it may be beneficial for organisations to join forces in order to better manage organising large scale ICs (van Winden & Carvalho, 2019) and to gather more substantial suggestions. However, collaboration in itself is not without its problems, and therefore the costs and downsides of collaborating should also be weighed in (Vivona et al. 2022). The advantages and disadvantages of collaborating to organise ICs are therefore of great importance, yet have scarcely been investigated in prior studies.

There is certainly not much research available on how multiple organisers in cross-border collaboration manage ICs. Prior research has usually covered ICs whose organisers, also referred to as seekers (Hu et al., 2023), are single individuals or organisations (Adamczyk et al., 2012; Ikävalko & Lempiälä, 2019). Further, in prior research the focus has either been on the contestants (Boudreau et al., 2011; Burke & Morley, 2016) or on the organiser (Hu et al., 2023; Komssi et al., 2015; Medina Angarita & Nolte, 2020; Rys, 2021; Rys, 2022; Vrolijk et al., 2021; Wikhamn, 2013). As far as we know, there have been no studies of international ICs managed by multiple organisations in cross-border collaboration and focusing on the pre-contest phase. This calls for further research and has informed the formulation of the research question that has guided us in this study.

This paper was presented at the XXXIV ISPIM Innovation Conference, held in Ljubljana, Slovenia on 04 June to 07 June 2023. Editors: Iain Bitran, Leandro Bitetti, Steffen Conn, Jessica Fishburn, Paavo Ritala, Marko Torkkeli & Jialei Yang. ISBN 978-952-65069-3-7.

3 Research question

What problems occur, if any, when multiple organisations manage an international IC in cross-border collaboration, and how to overcome these?

4 Research design

We have conducted a case study following the methodology of Yin (2014), studying an international IC managed in cross-border collaboration by professional innovation management organisations.

Case study: Sample and empirical setting

Ten science and technology parks and one university in nine European countries (Austria, Estonia, Finland, Germany, Lithuania, Poland, Portugal, Slovenia, and Sweden), created a Consortium (Table 1).

Table 1 The Consortium partners

The Consortium	
Organisation	*Location*
Civitta Eesti AS*	Estonia
CyberForum e.V.	Germany
Energiesparverband Oberosterreich	Austria
Globaz, S.A.	Portugal
Mälardalen University	Sweden
Pomorska Specjalna Strefa Ekonomiczna	Poland
Tallinn Science Park Tehnopol*	Estonia
Tehnoloski Park Ljubljana Doo	Slovenia
Turku Science Park*	Finland
Kaunas Science and Technology Park*	Lithuania
UNICORN Start-up and Innovation Hub (Zwi Zentrum Für Wissens- Und Innovationstransfer) GmbH	Austria
*) Project initiator	

In cross-border collaboration, the Consortium developed and organised an international IC intended to engage SMEs (including start-ups) in solving challenges for the urban social environment relating to Health Tech, Green Tech, and Smart Cities. The aim was to accelerate the development of new solutions for urban environmental challenges. The Consortium targeted SMEs for the IC for several reasons. In the overall European economy, SMEs make up approximately 99% of all companies.[1] They employ about 84.6 million people[2] and generate close to 4 trillion euro for the European economy.[3] Further, it

[1] https://single-market-economy.ec.europa.eu/smes_en, retrieved 2023-01-20.

[2] https://www.statista.com/statistics/936845/employment-by-smes-in-european-union/, retrieved 2023-01-20.

[3] https://www.statista.com/statistics/936386/value-added-by-smes-in-eu-member-states/, retrieved 2023-01-20.

is easier for smaller companies than for larger ones to change the direction of their business (Kuckertz *et al.*, 2010; Narasimhalu, 2005). On the other hand, compared to large companies small companies usually have fewer resources available for the development of new solutions (Aramburu & Sáenz, 2011), which is a reason to use an IC to stimulate SME engagement. If the IC is successful, SMEs would potentially solve urgent matters and further contribute to the European economy.

In line with the findings of previous research on ICs (Terwiesch & Ulrich, 2009; van Winden & Carvalho, 2019), the case study IC follows four phases to identify the most promising solutions step by step: exploration, ideation, implementation, and international market launch. The present paper is restricted to the first two phases in order to capture the pre-contest activities, i.e. exploration and ideation.

Phase 1, exploration, focused on identifying challenges suitable for SMEs to solve and consisted of three parts: challenge mapping, cross-country analysis, and building a virtual library of the challenges. In order to identify challenges across the three urban industries of Health Tech, Green Tech, and Smart Cities, each Consortium partner attracted key stakeholders such as local authorities, big corporates, municipalities, SMEs, entrepreneurs, researchers, policymakers, specialists, and experts for challenge mapping. This involved applying various methods – people-centered approaches, ethnographic research methods, co-design, system analyses, and foresight – during pre-workshop fieldwork to collect data and co-create workshops, seminars, or meetings with stakeholders in each Consortium country. The challenges were registered in a structured format with a limited number of characters to enable a concise description of each challenge and its expected results. The challenges were then evaluated based on novelty and the possibility of developing solutions within the timescale of the project. The challenges were entered into a database and sorted into the three urban industries and their application fields, with similar challenges in different countries grouped together in the different application fields (Appendix 1). Each challenge had a challenge owner who provided the data, challenge description or case at the subsequent open call and hackathons, the development and demonstration activities preparatory to phase two (described in the following paragraph). Additionally, a list was established of partnering science parks offering business support services to the companies addressing the challenge. The challenges were evaluated by an international panel regarding their novelty and the possibility of developing solutions within the time allowed for the IC. The database of challenges was turned into an open-access virtual library[1], which visualised the challenges, outlined the issues, and sorted them into the relevant tech field and country. The purpose of the virtual library was to ease communication with SMEs and to feed into the ideation phase (phase two) and subsequent phases: implementation (phase three) and the international market launch (phase four). A design thinking and service design approach was applied in order to understand needs, encourage the envisioning of new solutions, and enable cooperation (Brown, 2019).

Phase 2, ideation, focused on identifying the best potential solutions that could be further developed into functional prototypes and, later, launched on the market. This comprised two parts: open call and international workshops. To ease the communications, the workshops were called hackathons (as also noticed above). In the open call, which was marketed by the Consortium and its networking partners, totalling 69 organisations

[1] https://www.urbantech-project.eu/virtual-library/, retrieved 2023-01-09.

(Appendix 2), the SME contestants submitted short proposals (proposal) using a predefined form (Appendix 3) describing, for example, the proposed solution, the value created and the team. An international expert committee and the challenge owners evaluated the proposals, based on challenge fit, novelty and business potential. The highest-ranked proposals were invited to a hackathon for further development into a conceptual solution. The hackathons were distributed among eight of the Consortium partners and they were run in the course of one month (Appendix 4). All hackathons followed the same structure (Appendix 5). To stimulate SME participation, travel vouchers to a maximum of 850 euro were offered. At the hackathons, participants were offered coaching by mentors and training in presenting their pitch. The solutions were evaluated by an international expert committee and the challenge owner on the basis of seven criteria: challenge fit, scientific or technological excellence, market need, business potential, execution potential, market impact, and international potential.

All told, the IC met or exceeded all its set goals. In phase 1, 300 challenge owners from 12 countries were engaged, generating 310 challenges within the three, previously listed, urban environment areas. In phase 2, over 2,000 SMEs were contacted by the Consortium and its networking partners about the open call. In the open call, 559 proposals by 318 SMEs from 36 countries were submitted. After the proposals had been evaluated and ranked, 323 proposals were selected for further development at the eight hackathons. At the hackathons, 228 proposals by SMEs representing 28 countries were further developed into solutions. The 80 highest-ranked solutions were selected for the third phase, implementation.

Data collection and analysis

The research question is a “what”-question which can be answered by a descriptive study. Data were collected through written reflections by the project managers in the Consortium’s partner organisations regarding the tasks carried out throughout the two phases, which equals to open-ended written questions and enables the respondents to express themselves in their own words and tends to generate rich answers (Keusch, 2014; Säfsten & Gustavsson, 2020) and also to be more truthful (Singer & Couper, 2017). Notes from Consortium meetings were also collected. The data were anonymised, charted and thematically analysed in accordance with the methodology developed by Boyatzis (1998) to identify clusters of problems related to the tasks associated with the first two phases of the IC. Here, we applied the investigator triangulation approach (Denzin, 1978; Oppermann, 2000). Specific keywords were used to identify issues: problem, issue, difficult, challenge, complication, concern, unfulfilled, shortcoming, obstacle, hindrance, and barrier.

5 Findings

Based on the data collected (Table 2–5), several issues and difficulties became apparent in the process of collecting challenges and engaging SMEs. Some of the main issues included the time-consuming nature of collecting challenges, difficulty in convincing challenge owners to participate, low social media response, and a lack of motivation to participate among SMEs. Additionally, the complexity of the program and a lack of understanding of what constitutes a challenge also seemed to be hurdles. The economic situation was also cited as a factor that made promotion of the project difficult. However, various measures

used to overcome these problems were also identified in the data collected. Some of these measures included using direct calls and individual meetings with companies and incubators to generate interest, providing standardised proposals to applicants, organising information events to explain the open call, and utilising accelerator programs for promotion. The data indicate that targeting specific solution providers for specific challenges was effective, as was keeping the promotion process simple and sending detailed information later. Furthermore, it was noted that social media posts about specific challenges were the most effective, and promotion of challenges by the challenge owners was useful. Finally, the EISMEA (European Innovation Council and SMEs Executive Agency) site was considered essential for the success of the project.

From the data, we have identified four main problem-related themes relevant when organising international IC by multiple organisations in cross-border collaboration: *collaboration, coordination, communication, and commitment.* We also found answers to the problems identified, charted below in Table 2–5, divided by the two phases.

Table 2 Problems and answers, Phase 1: Challenge mapping

Phase 1: Challenge mapping					
Problems	*Answers*	*Theme*			
		Colla-boration	*Coordi nation*	*Communi-cation*	*Commit-ment*
"The most difficult so far has been collecting the challenges and keeping the Challenge Owners onboard until hackathons."	"General inquires could be submitted by potential applicants to opencall@urbantech-project.eu."			X	X
"The process of collecting challenges from challenge owners took more time than assumed." (referring to the work with aligning established work processes for the Consortium partners)	The Consortium spent much time getting to know each other and communicated openly and polite. They met in person in Ljubljana, Slovenia, in the beginning of the IC to establish trust (note from consortium meeting)	X	X	X	
"The challenge collection period included several holidays."	The Consortium rescheduled submission deadlines (note from consortium meeting)		X	X	X
"Collecting challenges related to Health Tech sector turned out more challenging due to the special characteristics of the industry."					X

"It was challenging bringing in challenges but that was nothing against the issues with getting SMEs engaged. Several SMEs were interested but they did not find the time or felt that the reward (and timeline) was not worth the time and effort required to submit solutions."		X	X
"Also, the challenge was to convince challenge owners that the project is capable to bring the solutions."		X	X
"We faced difficulties in collecting 30 challenges as the project was very complex."	"Standardized proposal for the applicants."	X	X
"The process of navigating Challenges for submitting a short proposal, for participating in a hackathon which then could give the chance of entering URBAN TECH programme resulted slightly less attractive for SMEs and start-ups."	"This required more promotional effort and a more personalised and one-to-one approach for accompanying SMEs through the submission process."	X	X
"We faced difficulties at the beginning to collect the 30 challenges, as it took a lot more time than we had expected, it required more meetings/phone calls/online session per challenge than we had expected and it took us more time to work out and finalize the challenges than we had thought."		X	X
"The biggest problem was to convince institutions/large companies to get involved in the project as Challenge Owners."		X	X

"Unfortunately, two potential Challenge Owners failed to submit their challenge within the time limit set by us,"	"so we had to implement additional measures to resolve the issue."				X
"The promotion was difficult as the program is very complex and lot of information needed to understand"	"1-1 meeting with companies was very effective way of the promotion"			X	
	"Support needed to fill in the form"			X	X
	"A good practice was to keep the promotion process simple"			X	

Table 3 Problems and answers, Phase 1: Virtual library

Phase 1:Virtual library					
Problems	*Answers*	*Theme*			
		Colla-boration	*Coordi-nation*	*Communi-cation*	*Commit-ment*
"Moreover, the process was rather too long from collecting the challenge and presenting the potential solution – it took almost a year which was not reasonable to some of challenge owners and the challenges expired either in terms of technology or in terms of an importance."	"General inquires could be submitted by potential applicants to opencall@urbantech-project.eu."		X	X	

Table 4 Problems and answers, Phase 2: Open call

Phase 2: Open call					
Problems	*Answers*	*Theme*			
		Colla-boration	*Coordi-nation*	*Communi-cation*	*Commi-tment*
"It seems that (at least for [Country]) the workload for SMEs were very high at that moment."				X	X
"The main difficulties we face in the last period was the promotion of the open				X	

call during the summer period."			
"Social media responses were very low."	"Therefore we used direct calls and organize individual meetings with companies and incubators to interest them in the Open Call."	X	
	"Information events where Open Call can be explained found to be very helpful"	X	
	"Accelerator programs were useful for promotion"	X	X
	"Deadline had accelerated the application"	X	X
	"Targeting specific solution providers for the specific challenges were found to be effective"	X	
"Difficulties in motivating start-ups and SMEs to apply"	"It was a good practice not to send detailed information at the beginning and not overwhelming the SMEs/start-ups with trh information, detailed information was recommended to be sent later"	X	
	"The most effective social media posts were the ones about specific challenges and smart city sector was more trendy"	X	
	"Challenge Owners promoting their challenges was useful"	X	X
"The actual economic situation made difficult the promotion"			X

"Many start-ups were interested without having a legal entity"		X
"There was a need to explain what a challenge is"		X
	"EISMEA* site published was very essential" *) European Innovation Council and SMEs Executive Agency	X

Table 5 Problems and answers, Phase 2: Hackathon

Phase 2: Hackathon					
Problems	*Answers*	*Theme*			
		Colla-boration	*Coordi-nation*	*Communi-cation*	*Commit-ment*
"We did not expect to have such a large number of participants in our hackathon, which was quite a challenge to manage (also regarding the infrastructure at the hackathon location)"	"but we managed excellently by a tight and well-thought-out organisation of the event."	X	X		X

Problems and answers

Overall, difficulties were most frequently noticed in the activities related to challenge mapping and the open call. Regarding the challenge mapping, the data in this study suggest that the majority of the problems were related to promoting the program, identifying the challenge owners, and securing their commitment to the program. Similar issues were identified for the open call with the difference that here the issue was one of identifying solution providers, i.e. SMEs, that could solve the identified challenges. Fewer issues were detected related to the virtual library and the hackathons. However, the lengthy period of time that elapsed between the challenge mapping and the open call – through the creation of the virtual library – affected the open call negatively. In particular, the challenge owners' commitment to participate was affected and the data indicate that challenges sometimes became irrelevant in the course of the process. For the cross-border analysis, no particular issues were detected in the data collected.

Collaboration

The data suggest that collaboration difficulties appeared once, at the beginning of the challenge mapping. This might be unimportant but could also be significant. The Consortium partners struggled to mutually align each organisation's own well-defined

methodologies, such as target groups, evaluation forms and methods, and registration forms for challenges and solutions. This suggests collaboration issues, but is also related to coordination and communication issues which might have been caused by the fact that only four of the Consortium partners knew each other from before, reflecting an immature group structure (Wheelan, 2015) and the need for development of trust (Lubatkin *et al.*, 2001). To solve these issues, the Consortium spent much time learning from each organisation and developing methodologies and processes while building trust.

Coordination

The Consortium partners operated in multiple countries, which caused coordination issues regarding project activities and estimated timelines due to local holidays and summer vacation, especially during the challenge mapping activities. They solved such issues by extending deadlines for submissions and rescheduling activities, such as marketing activities. However, as the tasks became more time-consuming than first estimated, difficulties with internal coordination appeared as more meetings were required. Further, because of the substantial delay before the virtual library was available, there are indications of coordination difficulties related to that work. This was partly solved by enabling general inquiries to be submitted by potential applicants to the project organisation. Also, thanks to well-developed coordination skills, hackathons with more participants than expected were well executed. Such coordination issues contribute to previously signalled gaps in research concerning the support structures and co-creation spaces needed for improved organizing and results of ICs (Adamczyk *et al.*, 2012).

Communication

The data from the present study suggest that communication issues were by far the most significant problem. In the Consortium, there were both internal and external communication issues. Internally, it was difficult to communicate progress and estimate workload according to the time plan. Externally, throughout the challenge mapping and the open call, attracting challenge owners and SMEs to the IC and providing them with sufficient information about the contest at the right time was not easy. The problems stem from the process of aligning and developing methodologies, and the low level of work activities carried out during the summer vacation. Such problems resonate with difficulties characterising larger ICs, related to e.g. increased bureaucratic practices (van Winden & Carvalho, 2019) . Answers to these problems that were considered successful included direct meetings with challenge owners and SMEs, as well as the ability to communicate information about the IC in small steps and provide more detail on request, i.e. providing a brief introduction about the IC in the beginning and directing interested parties to the website for specific details.

Commitment

The data collected identified external commitment issues, i.e. difficulties getting challenge owners and SMEs to commit to participate in the IC. It was nearly one year between the challenge collection and the hackathons, which slowed down the momentum and meant participants lost interest. According to prior research, extrinsic motivators, such as IC rewards, as well as intrinsic motivators such as community feedback need to be combined to achieve high degrees of commitment and motivation among IC participants (Adamczyk

et al., 2012) and since not all motivators can be controlled by organizers, it can be a difficult and cumbersome task to inspire commitment. To keep participants committed and to establish relationships the Consortium partners spent time on recurrent and one-to-one meetings with challenge owners and SMEs. They also provided hands-on support with submission of challenges and solutions to the IC. In addition, the current financial situation made it difficult for SMEs to participate. There were no commitment issues detected among the Consortium partners. Rather the opposite, as they solved problems as they appeared and reached all goals for the IC. For example, the Consortium was heavily affected by the Covid-19 situation where live promoting events could not be organised, and therefore found other ways to reach potential challenge owners.

6 Contribution

Theoretical contributions

This research has focused on the pre-contest phases of an international IC organised by multiple organisations in cross-border collaboration. This study thus contributes to prior studies on ICs organised by single organisers (Adamczyk et al., 2012; Hu et al., 2023; Ikävalko & Lempiälä, 2019; Komssi et al., 2015; Medina Angarita & Nolte, 2020; Rys, 2021; Rys, 2022; Vrolijk et al., 2021; Wikhamn, 2013). Four specific problem areas were identified – collaboration, coordination, communication, and commitment. Collaboration and coordination issues were internal, while communication issues were both internal and external, while commitment issues were external. To solve both internal and external issues, the ability of the Consortium partners to communicate openly and build trust in each other, as well as their commitment, were key factors.

Limitations and future work

Even though the IC in this study was large, the case is relatively small, which limits the scope for generalisation. On the other hand, data were collected through open written questionnaires, which improves their trustworthiness, and therefore we are confident about our findings. Nonetheless, we recommend further investigation of this IC as there may be solutions already developed but not available as data at the time of this study, and also studies on other ICs in similar settings. Further, we suggest research on the remaining two phases (implementation and commercialisation) to study potential additional problems and ways of dealing with them for ICs organised by multiple organisations in cross-country collaboration.

7 Practical implications

A great deal of experience was acquired by the Consortium, which would be useful for future international ICs arranged by multiple organisations in cross-border collaboration. For example: holidays (including local and international holidays) should be planned for in advance to allow time for marketing activities and submissions; methodologies and structure for communication should be developed before challenge owners and solution providers are approached, so as to reduce lack of clarity and avoid wasting valuable time;

time should be allocated for multiple in-person meetings with challenge owners and solution providers in order to establish commitment; it should be remembered that there are fewer solution providers in areas affected by strict legal regulations; several contacts should be established in each organisation, as institutional commitment may be affected by people changing jobs; in view of the limited time available for all stakeholders time should be allocated to support challenge owners and solution providers in their submission of forms. However, also consider the limitations of this study, as detailed above.

Acknowledgement

This research was funded by the European Union's Horizon 2020, grant agreement ID: 101005301. https://cordis.europa.eu/project/id/101005301 (retrieved 2023-04-28) and Mälardalen University.

References

Adamczyk, S., Bullinger, A.C. and Möslein, K.M. (2012), "Innovation Contests: A Review, Classification and Outlook", *Creativity and Innovation Management*, Vol. 21 No. 4, pp. 335–360, doi: 10.1111/caim.12003.

Almenar, J.B., Elliot, T., Rugani, B., Philippe, B., Navarrete Gutierrez, T., Sonnemann, G. and Geneletti, D. (2021), "Nexus between nature-based solutions, ecosystem services and urban challenges", *Land Use Policy*, Elsevier Ltd, Vol. 100, doi: 10.1016/j.landusepol.2020.104898.

Aramburu, N. and Sáenz, J. (2011), "Structural capital, innovation capability, and size effect: An empirical study", *Journal of Management & Organization*, Vol. 17 No. 3, pp. 307–325.

Bertello, A., Bogers, M.L.A.M. and De Bernardi, P. (2022), "Open innovation in the face of the COVID-19 grand challenge: insights from the Pan-European hackathon 'EUvsVirus'", *R&D Management*, John Wiley and Sons Inc, Vol. 52 No. 2, pp. 178–192, doi: 10.1111/radm.12456.

Boudreau, K.J., Lacetera, N. and Lakhani, K.R. (2011), "Incentives and Problem Uncertainty in Innovation Contests: An Empirical Analysis", *Source: Management Science*, Vol. 57 No. 5, pp. 843–863.

Boyatzis, R.E. (1998), *Transforming Qualitative Information: Thematic Analysis and Code Development*, Sage.

Brown, T. (2019), *Change by Design, Revised and Updated*, HarperCollins Publishers, New York, New York, NY.

Burke, C.M. and Morley, M.J. (2016), "On temporary organizations: A review, synthesis and research agenda", *Human Relations*, SAGE Publications Ltd, Vol. 69 No. 6, pp. 1235–1258, doi: 10.1177/0018726715610809.

Denzin, N.K. (1978), *The Research Act*, 2nd ed., McGraw-Hill, New York.

Desouza, K.C. (2012), "Challenge.gov: Using Competitions and Awards to Spur Innovation", *IBM Center for the Business of Government*, Vol. 10 No. 17.

DiSalvo, C., Gregg, M. and Lodato, T. (2014), "Building Belonging", *Interactions*, Vol. 21 No. 4, pp. 58–61.

Gama, K. (2017), "Preliminary Findings on Software Engineering Practices in Civic Hackathons", *Proceedings - 2017 IEEE/ACM 4th International Workshop on*

CrowdSourcing in Software Engineering, CSI-SE 2017, Institute of Electrical and Electronics Engineers Inc., pp. 14–20, doi: 10.1109/CSI-SE.2017.5.

Haller, J.B.A., Bullinger, A.C. and Möslein, K.M. (2011), "Innovation contests: An IT-based tool for innovation management", *Business and Information Systems Engineering*, Vol. 3 No. 2, pp. 103–106, doi: 10.1007/s12599-011-0147-7.

Hjalmarsson, A., Juell-Skielse, G. and Johannesson, P. (2017), *Open Digital Innovation A Contest Driven Approach*, Springer.

Hu, F., Huizingh, E. and Bijmolt, T. (2023), "Innovation contests: attracting new solvers and new high-quality solutions", *R and D Management*, John Wiley and Sons Inc, Vol. 53 No. 1, pp. 149–167, doi: 10.1111/radm.12553.

Ikävalko, H. and Lempiälä, T. (2019), "Innovation contests, routine dynamics and innovation management", *Creativity and Innovation Management*, Life Science Publishing Co. Ltd, Vol. 28 No. 2, pp. 191–202, doi: 10.1111/caim.12299.

Keusch, F. (2014), "The influence of answer box format on response behavior on list-style open-ended questions", *Journal of Survey Statistics and Methodology*, American Association for Public Opinion Research, Vol. 2 No. 3, pp. 305–322, doi: 10.1093/jssam/smu007.

Komssi, M., Pichlis, D., Raatikainen, M., Kindstrom, K. and Jarvinen, J. (2015), "What are Hackathons for?", *IEEE Software*, IEEE Computer Society, Vol. 32 No. 5, pp. 60–67, doi: 10.1109/MS.2014.78.

Kuckertz, A., Kohtamäki, M. and Droge gen. Körber, C. (2010), "The fast eat the slow – the impact of strategy and innovation timing on the success of technology-oriented ventures", *International Journal of Technology Management*, Vol. 52 No. 172, pp. 175–188.

Lubatkin, M., Florin, J. and Lane, P. (2001), "Learning together and apart: A model of reciprocal interfirm learning", *Human Relations*, Vol. 54 No. 10, pp. 1353–1382.

McGahan, A.M., Bogers, M.L.A.M., Chesbrough, H. and Holgersson, M. (2021), "Tackling Societal Challenges with Open Innovation", *California Management Review*, SAGE Publications Ltd, Vol. 63 No. 2, pp. 49–61, doi: 10.1177/0008125620973713.

Medina Angarita, M.A. and Nolte, A. (2020), "What Do We Know About Hackathon Outcomes and How to Support Them? – A Systematic Literature Review", *Collaboration Technologies and Social Computing*, Springer Science and Business Media Deutschland GmbH, pp. 50–64, doi: 10.1007/978-3-030-58157-2_4.

Narasimhalu, A.D. (2005), "Innovation Cube: Triggers, Drivers and Enablers for Successful Innovations", *International Society of Professional Innovation Management, 19th-22nd of June*, Porto, Portugal .

Oppermann, M. (2000), "Triangulation ? a methodological discussion", *International Journal of Tourism Research*, Wiley, Vol. 2 No. 2, pp. 141–145, doi: 10.1002/(sici)1522-1970(200003/04)2:2<141::aid-jtr217>3.0.co;2-u.

Pihlajamaa, M. and Merisalo, M. (2021), "Organizing innovation contests for public procurement of innovation–a case study of smart city hackathons in Tampere, Finland", *European Planning Studies*, Routledge, Vol. 29 No. 10, pp. 1906–1924, doi: 10.1080/09654313.2021.1894097.

Rys, M. (2021), "Invention Development. The Hackathon Method", *Knowledge Management Research and Practice*, Taylor and Francis Ltd., doi: 10.1080/14778238.2021.1911607.

Rys, M. (2022), "Characteristics of invention development during the hackathon", *Convergence*, SAGE Publications Ltd, Vol. 28 No. 6, pp. 1800–1825, doi: 10.1177/13548565211070418.

Säfsten, K. and Gustavsson, M. (2020), *Research Methodology*, Studentlitteratur, Lund.
Singer, E. and Couper, M.P. (2017), "Some Methodological Uses of Responses to Open Questions and Other Verbatim Comments in Quantitative Surveys", *Methods, Data, Analyses*, Vol. 11 No. 2, pp. 115–134, doi: 10.12758/mda.2017.01.
Terwiesch, C. and Ulrich, K.T. (2009), *Innovation Tournaments: Creating and Selecting Exceptional Opportunities*, Harvard Business Press.
Vrolijk, A., Roman, M.C. and Szajnfarber, Z. (2021), "Mapping the Benefits from Innovation Contests", *Research Technology Management*, Routledge, Vol. 65 No. 1, pp. 29–38, doi: 10.1080/08956308.2022.1993683.
Wheelan, S.A. (2015), *Creating Effective Teams - A Guide for Members and Leaders*, Sage Publications inc.
Wikhamn, B.R. (2013), "Challenges of implementing innovation contests to facilitate radical innovation", *Int. J. Networking and Virtual Organisations*, Vol. 13 No. 2, pp. 129–145.
van Winden, W. and Carvalho, L. (2019), "Intermediation in public procurement of innovation: How Amsterdam's startup-in-residence programme connects startups to urban challenges", *Research Policy*, Elsevier B.V., Vol. 48 No. 9, doi: 10.1016/j.respol.2019.04.013.
Yin, K.R. (2014), *Case Study Research*, 5th ed., SAGE Publications Inc., Thousands Oaks.

*) https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html, retrieved 2022-01-03

Appendices

Appendix 1 Content in form for challenge owners to use to describe the challenge(s).

Content in form for challenge owner to describe the challenge
Title of the Challenge (70 characters maximum) *A catchy title that expresses well what the challenge is about will increase the chances that the challenge will be selected*
Short description (300 characters maximum) *Short summary of the challenges: What is it about? Why is a solution needed and by whom? Why has the problem not been solved yet/why is this challenge new? (e.g. changes in legislation, advance in technologies)*
Enter five keywords to describe the challenge *Please try to be as precise as possible! For inspiration, you can, for example, refer to EEN Keywords Technologies and EEN Keywords Markets* *(https://een.ec.europa.eu/tools/Help/WH/MPUG/Appendices/A_MK/A_MK.htm)* *(https://een.ec.europa.eu/tools/Help/WH/MPUG/Appendices/B_TK/B_TK.htm)*
Market potential (200 characters maximum) *Further information on application ideas for potential solutions, including estimation of market volume for the solutions, potential other users of the solution, other relevant markets/ stakeholders; localization and relevant regulations; risks and costs can be provided here. The more hard facts and data provided, the better.*
Timing (200 characters maximum) *When is the solution needed? All matters regarding the maturity of the challenge, how soon solutions are needed or when the challenge owner is ready to proceed, can be added here.*

Type of solution

Which type of solution is needed/welcome/useful? This is really critical information for the "solution providers" (SMEs/start-ups).

- ☐ Software solution, for example:
  - ☐ Productivity tools
  - ☐ Data-related solutions
  - ☐ AI and machine learning tools
  - ☐ Production software
  - ☐ Project or time management solution
  - ☐ Other software solution
- ☐ Hardware solution, for example:
  - ☐ IoT and sensors
  - ☐ Robotics and automatization
  - ☐ Custom-made hardware solution
  - ☐ Other hardware solution
- ☐ Finance or business model
- ☐ Improvement of an existing process
- ☐ New technological approach
- ☐ Service development
- ☐ Other type of solution

If "Other solution" was chosen, please provide a brief description (100 characters maximum)

Urban Tech Solution Category

- ☐ Greentech
- ☐ Health Tech
- ☐ Smart City

Desired results/outcome from the perspective of the challenge owner
(300 characters maximum)

Location

☐ Austria	☐ France	☐ Malta
☐ Estonia	☐ Lithuania	☐ Spain
☐ Italy	☐ Slovakia	☐ Czech Republic
☐ Portugal	☐ Croatia	☐ Hungary
☐ Belgium	☐ Germany	☐ Netherlands
☐ Finland	☐ Luxembourg	☐ Sweden
☐ Latvia	☐ Slovenia	☐ Denmark
☐ Romania	☐ Republic of Cyprus	☐ Ireland
☐ Bulgaria	☐ Greece	☐ Poland

This paper was presented at the XXXIV ISPIM Innovation Conference, held in Ljubljana, Slovenia on 04 June to 07 June 2023. Editors: Iain Bitran, Leandro Bitetti, Steffen Conn, Jessica Fishburn, Paavo Ritala, Marko Torkkeli & Jialei Yang. ISBN 978-952-65069-3-7.

Sector

Please select one sector: public or company

☐ Public body, institution or other non-profit organization
(If this option is selected, details must be added: e.g., city council, region, public hospital, school administration, university, … - field to fill in): (70 characters)

☐ Company
(If this option is selected, please tick more details below. Please describe in your own words the business area in which the challenge owner is active.) (70 characters)

Type of company (number of staff): (only 1 answer possible)
- ☐ Micro SME (< 10 staff)
- ☐ Small SME (10-49 staff)
- ☐ Mid-size SME (50-259 staff)
- ☐ Mid-Cap (250-3,000 staff)
- ☐ Large company (> 3,000 staff)

Market presence: (only 1 answer possible)
- ☐ active in one country
- ☐ active in several countries
- ☐ global presence

Business sector (according to NACE keywords):
- ☐ A – Agriculture, forestry and fishing
- ☐ B – Mining and quarrying
- ☐ C – Manufacturing
- ☐ D – Electricity, gas, steam and air conditioning supply
- ☐ E – Water supply; sewerage, waste management and remediation activities
- ☐ F – Construction
- ☐ G – Wholesale and retail trade, repair of motor vehicles and motorcycles
- ☐ H – Transportation and storage
- ☐ I – Accommodation and food service activities
- ☐ J – Information and communication
- ☐ K – Financial and insurance activities
- ☐ L – Real Estate activities
- ☐ M – Professional, scientific and technical activities
- ☐ N – Administrative and support service activities
- ☐ O – Public administration and defence, compulsory social security
- ☐ P – Education
- ☐ Q – Human health and social work activities
- ☐ R – Arts, entertainment and recreation
- ☐ S – Other service activities
- ☐ T – Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
- ☐ U – Activities of extraterritorial organizations and bodies

Commitment of the challenge owner (200 characters maximum)
Is the challenge owner willing to provide further support (financial/non-financial), information, etc. What type of support? Is there any other relevant information about the challenge owner?

Other information (300 characters maximum)
(Any other information on the challenge or the challenge owner you would like to provide)

Contact information (For internal use only) Name of the company/institution Street Number Postal code City Website Name and Surname of the contact person Job location of the contact person Email of the contact person
Does the challenge owner want to be promoted on URBAN TECH channels, without a direct connection to any specific challenge? Yes No If yes, please upload challenge owner's logo and it will be presented in URBAN TECH channels!
Challenge completed and uploaded by (for internal use only) Organization's acronym Name Email Phone

Appendix 2 Networking partners to the Consortium

Networking partners to the Consortium (alphabetical order)		
AAL AUSTRIA	EIT Health	OHA Osnabrück Healthcare Accelerator
ACCIO'	EIT Urban Mobility	Pioniergeist/Start-upHub Stuttgart
Almi Företagspartner Mälardalen	Enterprise Europe Network	Polish Business and Innovation Centers Association
Austrian Incubators	European Cluster Collaboration Platform	Pomeranian ICT Cluster-INTERIZON
Automation Region	European Innovation Council and SMEs Executive Agency (EISMEA)	Project Smart Progress responsible for animated Pomeranian Smart Specializations
Badencampus	European Space Agency network	Reutlingen IHK
Baltic Eco-Energy Cluster	European/Israelian Incubators	Reutlingen University
Baltic Sea and Space Cluster	F6S	Six City Strategy Consortium
BioLago	Federane	Social Business Hub Styria
BioRegioStern	Federation of Finnish Enterprises	Solved-platform
Bird Incubator (Croatia)	Fiban/Finnish Business Angels	Sparkup hub
Boost Turku	Fintogether/Finance Accelerator Stuttgart	Start-up Europe Network
Brutkasten	Fokusenergie	Start-up Finland FB group
Bwcon	Grand Garage Linz	Start-up Slovenia
Chamber of Commerce GZS - Slovenia	Gruenhof Incubator Freiburg	Start-up BW Accelerator Network
City of Mannheim	HdM Stuttgart	Step RI (Croatia)

City of Tallinn	IASP (International Association of Science and Technology Parks and Areas of Innovation)	Stiftung Medizininnovationen
Collaborative Center	ICT Pomeranian Cluster - INTERIZON	Suomen Yrittäjät (post on their FB group)
Creative Science Park Aveiro Region Via do Conhecimento	INNOLAB FH CAMPUS 02	Swedish Incubators & Science Parks
dehub network Germany	Järnvägsklustret	TFU Start-up Center Ulm
DIH Agrifood	Kasvu Open's networks	Västmanland's research and development council
DIH network	Klaster LT (Clusters' organizations in LT)	Werstas hub
ECN Entrepreneurship Center Network	Medical Innovations Incubator Tübingen	WTC Turku

Appendix 3 Content of the form for SME to describe solution

Content in form for SME to describe the solution
Title of the solution (100 characters)
Goal of the solution (400 characters) *Description on how the solution is linked to the selected challenge.*
Description of the solution (2000 characters) *Details about the proposed solution, including relation to the state of the art of that scientific or technological field. Reference for any cross-industry, cross-sector aspect. Outline of business development solution, including market need and impact.*
Action plan and timing (1000 characters) *Explanation of the possible implementation of the solution, including time needed to develop.*
Presentation of the team (600 characters) *List of team members taking part in developing the solution. It is required that their F6S profile should also be shared.*
Applicant information *In addition to the shared company F6S profile, some basic data and the contact person details were asked. The applicants were required to register a profile at F6S before submitting their short proposal and share the below basic information about the company.* • Short description • Location • What markets are you in? • What stage are you at? • Links • Mobile Apps • Are you raising money? • Past funding and investors • How do customers use or interact with your product? • Are you registered or incorporated? • When did you start?

Appendix 4 Hackathons by the participants

International Hackathons		
Date	***Organising STP/AOI***	***Location***
10-11 November 2022	Tehnopol Science and Business Park	Tallinn, Estonia
14-15 November 2022	OÖ Energiesparverband	Linz, Austria
18-19 November 2022	Kaunas Science and Technology Park	Kaunas, Lithuania
22-23 November 2022	Technology Park Ljubljana	Ljubljana, Slovenia
23-24 November 2022	Turku Science Park	Turku, Finland
25-26 November 2022	UNICORN Start-up and Innovation Hub	Graz, Austria
29-30 November 2022	Gdańsk Science and Technology Park	Gdańsk, Poland
29 November 2022	CyberForum e.V	Karlsruhe, Germany

Appendix 5 Hackathon structure

Hackathon structure	
Tentative time schedule	***Activity***
09:00-09:15	Welcome
09:15-09:45	Inspirational session and Challenge Owners introduction
09:45-10:15	Information about final pitches and next steps
10:15-10:30	Break
10:30-12:00	Meeting with Challenge Owners and Teamwork
12:00-13:00	Lunch
13:00-14:00	Teamwork
14:00-15:30	Mentoring session
15:30-16:00	Break
16:00-18:20	Pitching session
18:20-18:40	Jury meeting/Break
18:40-19:00	Announcements of the winners
19:00-21:00	Buffet dinner