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Title	Open social innovation in response to grand challenges: promotor influence as change agent
Authors	Barrett, Gillian;Dooley, Lawrence
Publication date	2025-03
Original Citation	Barrett, G & Dooley, L 2025, 'Open social innovation in response to grand challenges : promotor influence as change agent', R and D Management, vol. 55, no. 2, pp. 405-419. https://doi.org/10.1111/radm.12695
Type of publication	Article (peer-reviewed)
Link to publisher's version	https://www.scopus.com/pages/publications/85197317842 - 10.1111/radm.12695
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Open social innovation in response to grand challenges: promotor influence as change agent

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Following on from the R&D Management COVID-19 two-part special issue editorial, this paper strives to deepen our knowledge of Open Social Innovation (OSI) in such grand challenge contexts through exploring the promotor role(s) and interventions in managing temporary organisations. Through an exploration of three case studies that emerged from a bottom-up perspective, in response to the COVID-19 grand challenge, this study highlights the central role played by promotors in leveraging OSI projects. The core elements of the George et al. (2016) grand challenge framework are explored within the cases, through a promotor theory lens, to understand how the promotor roles (power, process, technology and relationship) influence the emergence of the temporary OSI organisation to enable a societal contribution. The research recognises the potential of OSI as a response to future grand challenges, highlighting the importance of management routines, such as communicating and articulating the need, adoption of project management practices, leveraging network ties through promotors' credibility and co-ordinating partners (& volunteers) for nurturing objective achievement. The research also highlights impediments that can curtail progress, which potentially impacts the longevity and outcomes of OSI. This study demonstrates the important role of promotors in initiating OSI communities to respond to grand challenges and given the complexity and enormity of the task, promotors must establish routines to engage and co-ordinate a collective ecosystem, since they cannot execute alone. Thus, OSI communities require assistance from government and/or commercial entities to exploit and effectively co-ordinate such OSI endeavours to ensure a meaningful contribution.

1. Introduction

Grand challenges are complex, uncertain and evaluative with unclear solutions (Ferraro et al., 2015; Ritala, 2024) and include climate change, global poverty, mass migration and emerging pandemics (such as the recent COVID-19), that society looks to R&D to address. While the benefits of solving such grand challenges are obvious, the scale, complexity, and psychological barriers to action of the challenge, often leave individuals feeling powerless regarding their ability to make real change. To date, this has primarily left efforts to address the challenges within the remit of Governments and globally scaled organisations (e.g. United Nations, non-governmental organisations (NGOs) such as

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the Gates Foundation). Yet, significant numbers of societal actors (such as individuals, communities and independent organisations) are passionate and wish to contribute to solving specific challenges. The past decades has seen a greater understanding of the open innovation (OI) paradigm and emerging Governmental efforts to engage societal actors as a 'force for change' but, as of yet, our understanding of how to meaningfully harness the power and creativity of wider society for social innovation advancement is in its infancy (Ahn et al., 2019).

Recognising the importance of the COVID-19 pandemic context (Bacq et al., 2020; Rouleau et al., 2020), R&D Management championed a two-part special issue to document the emerging community response to the COVID-19 challenge (29 case articles from 113 submissions). The articles published within the two special issues (Di Minin et al., 2021; Mortara et al., 2022), demonstrated the leverage of bottom-up, networked global responses whereby motivated individuals actively sought avenues to contribute their capabilities to solve problems. Reflecting on these collective initiatives, Mortara et al. (2022) acknowledged the potential of open social innovation (OSI) initiatives not only when addressing grand challenges but also identified the numerous constraints curtailing the effectiveness of each OSI initiative, together with gaps in our theoretical and managerial understanding. In essence, we have much to learn regarding what influences effectiveness since factors impacting OSI may be different to the innovation management practices derived from commercial enterprises (e.g. organic scale/recruitment, voluntary nature, driven solely by purpose and even the temporary nature of the organisation). It is in this context that this paper is positioned.

Open Innovation (OI) (Chesbrough, 2003) has championed a more inclusive, networked approach to innovation development, whereby a synthesis of outward-in and inward-out knowledge flows occur to advance innovation and deliver pecuniary and non-pecuniary benefits. An OI approach has long acknowledged the synergistic collaborative potential across multiple contexts (Dahlander and Gann, 2010; Bogers et al., 2018), including for the economic benefit of both large (Chesbrough and Brunswicker, 2013; Mortara and Minshall, 2014) and small (Bianchi et al., 2010; Greul et al., 2018) organisations, offering opportunities for reducing costs, forgoing capital expenditure, sharing risk, accessing tacit knowledge and reducing development time. However, during its first two decades, the OI paradigm has broadened engagement beyond supply-chain partners and commercial-focused entities, to leverage capabilities and resources of more diverse sources such as public research centres, NGOs, lead users and the 'crowd' (Randhawa et al., 2019). The increasingly diverse engagement of OI has proven the potential of this ubiquitous knowledge of wider society when seeking novel and disruptive solutions (Boudreau and Lakhani, 2013). Recognising this evolution of OI and its potential for addressing pressing societal challenges, Chesbrough and De Minin (2014, p. 170) coined and defined the term Open Social Innovation (OSI) as 'the application of either inbound or outbound open innovation strategies, along with innovations in the associated business model of the organization, to address social challenges'. Subsequently, recent years has witnessed an increased adoption of OSI through temporary organisations in response to the ever increasing and complex grand challenges (Di Minin et al., 2021; McGahan et al., 2021; Bertello et al., 2022; Mortara et al., 2022), greatly facilitated by motivated individuals (Ahn et al., 2019; Barrett et al., 2021), increased societal access to digital infrastructures, and the increasing visibility of grand challenge pressures on society.

OSI leverage in response to the grand challenges poses different demands to the traditional OI context, given the diversity of those involved, the complexity of the challenge and the network scale of those wishing to be involved. For OSI initiatives, collaborations tend to be organic, bottom-up initiatives, driven for societal benefits, that require different routines to OI routines that have evolved within more coordinated and bounded consortia, determined by economic rationale (Bertello et al., 2022). Understanding *how* OSI initiatives (Holmes and Smart, 2009; Chesbrough and Di Minin, 2014; Ahn et al., 2019; Kohler and Chesbrough, 2019; Mortara et al., 2022), can address grand challenges, is both theoretically interesting and socially important. Given the potential for diverse and large numbers of voluntary contributors, OSI decisions taken during the early stages of the process, can have significant impact on the operation and eventual outcome of the initiative. Such decisions include the control of participation and selection of individual actors, the origins of resources/capabilities to be leveraged, the choice of actions progressed, and how such networks will be managed, all of which will determine the effectiveness of OSI operation, the outcome realised, and the value achieved for society. Thus, key individuals, championing such OSI initiatives, will significantly influence the reality within OSI operations, and the effectiveness of the collective effort. Witte (1973, p. 15) defined such key individuals as promotors 'who actively and intensively support the innovation process'. Given their importance,

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understanding the role of how promotors influence the OSI actions in response to their grand challenge context (Fichter, 2009) will allow us to learn how the OSI process can be better realised for future benefit. Therefore, in advancing the editorial calls of Di Minin et al. (2021) and Mortara et al. (2022), we pose the following research question: 'How do promotors influence OSI initiatives in response to a grand challenge?'

Through an exploration of three case studies that emerged from a bottom-up perspective in response to the COVID-19 grand challenge, this study highlights the central role played by promotors in leveraging OSI projects. The core elements of the George et al. (2016) grand challenge framework are explored within the cases, through a promotor theory lens, to provide a deeper understanding of the complexity of the OSI process and insights into the impact of human intervention decisions made across the OSI process. Employing a multi-case, inductive study approach (Eisenhardt, 1989; Yin, 2009), the researchers explored the emerging reality of OSI and the influence of promotor interventions on the OSI operations (Saunders et al., 2016; Creswell and Creswell, 2017), identifying learning for future grand challenge innovation projects (Mortara et al. 2022). We contribute towards not only understanding how OI techniques can be leveraged in such organic societal contexts but also, connect OSI with promotor theory (Witte, 1977) and the grand challenge framework (George et al., 2016; Howard-Grenville, 2020), to comprehend *how* to enhance the effectiveness of OSI in achieving meaningful impact on grand challenges.

2. Theoretical background

George et al. (2016, p. 1,881) defined grand challenges as 'specific critical barrier(s) that, if removed, would help solve an important societal problem with a high likelihood of global impact through widespread implementation'. Grand challenges are ambitious and achievable objectives, and the discovery of addressable solutions can motivate and facilitate new strategies and knowledge (Locke and Latham, 2002; Eisenhardt et al., 2016; George et al., 2016). Ferraro et al. (2015) described grand challenges as 'intractable' puzzles with three analytical facets – complex, uncertain and evaluative. Grand challenges impact significant members of society but due to their complexity, can be described as 'wicked problems', whereby many interdependent factors make it seem impossible to solve (Ritala, 2024). An exploratory and pluralistic mode of inquiry into grand challenges was called for through the 'theorization of the arrows' within the George et al. (2016) framework, to help 'inform processes and relationships that drive and connect articulation, actions and outcomes and gives rise to specific trajectories' (Howard-Grenville, 2020, p. 4). We respond to this call, focusing on the 'spine' of the framework to examine the relationships between the core elements (articulating/participating in grand challenges, multi-level actions and outcomes/impact) and the role of the promotor, to better inform how future grand challenges could be tackled (Mortara et al., 2022).

To date, grand challenges have been primarily the domain of Government intervention, given the scope of the problem and resources required to impact same, but there are significant numbers of societal members who want and can contribute to resolving these challenges, for the betterment of all. The potential contribution of bottom-up OSI initiatives are immense (especially exhibited during COVID-19 pandemic) (Di Minin et al., 2021; Mortara et al., 2022) and champions of such initiatives, are likely to exhibit considerable influence on the process elements, including the eventual overall impact in addressing the grand challenge. Promotor theory (Witte, 1973) is founded on the premise that innovation success is dependent on key individuals. Promotors are defined as 'people who actively and intensively promote an innovation process. They initiate the process and push it along until the final innovation decision is made, overcoming barriers along the way' (Witte, 1973, p. 53). These barriers are categorised and overcome as follows. First, barriers of will are overcome through 'promotors of power' and second, barriers of capability are overcome through 'promotors of know-how' (Witte, 1977). Promotors of power participate through their leadership and hierarchical position, whilst promotors of know-how participate through their expertise, with co-operating in 'tandem', having the greatest opportunity for innovation success.

Promotor theory has subsequently been extended from Witte's (1977) 'dyadic' promotor structure to a 'troika' structure including 'power', 'technology' (i.e. expert/know-how) and 'process' promotors (Chakrabarti and Hauschildt, 1989). The 'process' promotor is adept at organisational know-how, understands the requirement to simplify the technical language and is needed to manage problem and system complexity (Hauschildt and Kirchmann, 2001). Thus, process promotors act as the conduit between the power and technology promotors, thereby influencing and communicating with other organisational members through building of personal relationships and safeguarding the innovation process (Gemünden and Walter, 1997). Subsequently, Gemünden and

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Walter (1995) developed a fourth promotor – the 'relationship' promotor, whose role is to develop relationships with parties internal and external to the organisation, using their extensive network linkages. The defining characteristic of relationship promotors is their extensive network linkages and ties, that is meaningful relationships with other parties (Pemartín et al., 2019), which they leverage for advantage. Table 1 provides a synopsis of the promotor roles and how these may impact on OSI initiatives being advanced by its champions.

Given the collaborative efforts and the opportunistic potential, OSI offers a way forward in addressing global societal challenges. Literature has overlooked the importance of OI in tackling such global societal challenges with several exceptions including Chesbrough and Di Minin (2014), Randhawa et al. (2019), Ahn et al. (2019), Rayna and Striukova (2019). In particular, the literature has neglected the important human role, that is, the role the promotor plays in leveraging OSI initiatives through a temporary organisation. Temporary organisational characteristics are strongly influenced by its project manager role (PM[1]) (Turner and Müller, 2003), with their motivation driving specific actions (Ludlin and Soderholm, 1995), to effect change.

This study strives to build on the evidence of the R&D Management special issues (Di Minin et al., 2021; Mortara et al., 2022), to explore the development of three COVID-19 focused OSI projects and the influence of the promotor role on the development and subsequent innovation outcome of these 'temporary organisations'. Through bridging promotor theory (Witte, 1977) with the grand challenge framework (George et al., 2016), in the context of OSI (Chesbrough and Di Minin, 2014), this research strives to better understand the leveraging of the potential of OSI initiatives to address future grand challenges. A conceptual framework (Figure 1) was developed to guide an exploration of the three selected OSI cases. We leveraged George et al.'s (2016) framework and the core elements (articulation/participation, actions and outcomes/impact) to explore the interactions between each element. George et al. (2016) framework is depicted as a linear process, but the reality is a non-linear, iterative and complex process (Howard-Grenville, 2020).

3. Methodology

To study the OSI potential in response to grand challenges, the research team concentrated on emerging societal responses during the initial waves of the COVID-19 pandemic. The research design adopted a multiple-case, inductive study due to its ability to provide unique and fascinating insights in a real life context, exploring the 'human perspective' (Eisenhardt, 1989; Yin, 2009; Saunders et al., 2016; Martinsuo and Huemann, 2021). The 2020–2021 time window produced hundreds of exemplars of OSI initiatives, varying greatly in scale, scope and longevity. For this study, case selection was based on the following criteria. First, the temporary organisations were high-profile responses to the COVID-19 grand challenge, attracting national and international attention and hence, an abundance of secondary data accessible. Second, longevity and scale of the initiatives were significant (>6 months), over the course of the first wave of the pandemic, allowing all three cases to mature and deliver outputs (albeit in different ways), in response to the grand challenge. Third, the OSI responses were instigated and driven by promotors, who maintained their relationship across its lifecycle and were willing to provide research access to their initiative. These selection criteria resulted in identification of three Irish-based cases of medical

Table 1. Promotor roles

Promotor role	Description
Power Promotor	A power promotor is '*any person who actively and intensively promotes an innovation process by mean of hierarchic power*'. (Witte, 1977, p. 53)
Technology (know-how) Promotor	A technology promotor is '*any person who actively and intensively encourages an innovation process by means of specific know-how…his interest in the innovation …. may be based on entirely personal interests*'. (Witte, 1977, p. 54)
Process Promotor	A process promotor '*derives his/her influence from organisational know-how. He forges the link between the technology and power promotor*'. (Hauschildt and Kirchmann, 2001, p. 42)
Relationship Promotor	A relationship promotor actively encourages an innovation process by leveraging its innovation related business relationships inside the organisation and externally with its partners. (Gemünden and Walter, 1997)

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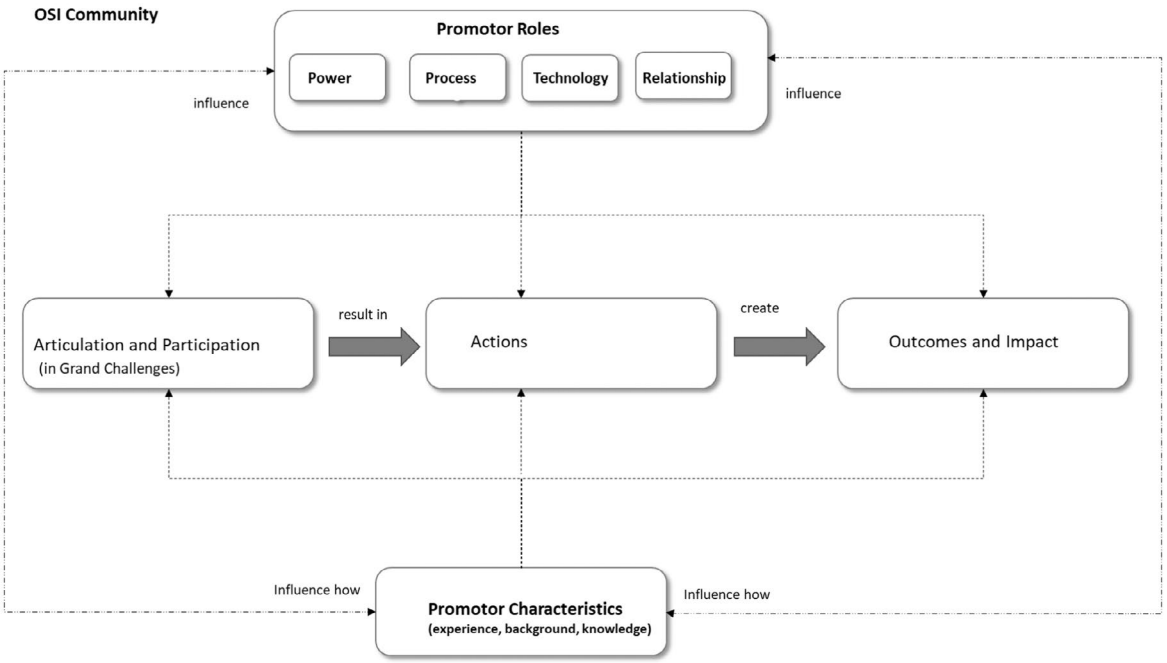


Figure 1. Conceptual framework (adapted from George et al., 2016).

technology (med-tech) temporary organisations, that were significantly *bottom-up*, society-driven, possessing the capabilities and expertise for potential positive action in response to the COVID-19 grand challenge.

To build depth and richness, this study leveraged three data sources (1) primary, longitudinal, semi-structured interviews with all key promotors of the cases in 2020 (April, May and November) and again in 2021 (March and October), (2) extensive secondary data including publicly available newspaper articles, television features, promotor interviews, news reports and social media commentary and (3) follow-up emails and video calls (post interview) for clarification purposes. In advance of the interviews, secondary data was analysed to identify research themes within the cases, which then informed the interview guide. The interview guide provided an initial structure but given the semi-structured nature, allowed divergence into areas important to that OSI project and emerging promotor reality. During each interview, additional documentation (confidential) was sometimes shared by the promotor and once redacted, was included in the analysis. The triangulation process (Yin, 2009) was facilitated through the collection of significant secondary data before and after the promotor interviews. Triangulation was also enabled by data gathered from initial interviews with promotors and follow-up calls for clarification, ensuring validity of the information being gathered.

Template data analysis was applied, with a four-stage deductive process (themes identified from OSI and promotor theories) applied as the theoretical frame and subsequently, an inductive process applied to understand the reality of the function and interrelationship across the process. In the first stage, the code book was generated which facilitated the category development process. The second stage involved identifying the categories and codes from the interview transcripts. Within each transcript, each line was examined, and conceptual coding applied using *in vivo* codes (Van Maanen, 1979), followed by second cycle coding methods using descriptive codes (Saldaña, 2012). This iterative process ebbed and flowed, back and forth between the data until patterns emerged (Spiggle, 1994; Siggelkow, 2007; Miles et al., 2014).

3.1. Case settings

The cases studied were high profile non-governmental, *bottom-up* responses to address the COVID-19 grand challenge. Each case was progressed as a temporary organisation to affect change and deliver on its evolving objectives. Passionate and committed promotors executed each OSI initiative and in so doing, behaved as organisational architects in co-ordinating the consortium of voluntary contributors. The three case studies scaled quickly in response to the immediacy of

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the challenge, drawing in significant resources and capabilities to support actions directed towards their objectives, during the period of the first wave of COVID-19 across Europe. The three cases are detailed as follows.

3.1.1. Case A

Case A is an OSI response to COVID-19 initiated in March 2020 by the CEO and co-founder of an Irish small and medium sized (SME) company. The technology was initially developed as an early warning detection wearable device and platform to alert individuals (and their organisations) if body temperature increased dramatically (COVID-19 symptom). This OSI project was purposefully executed by the Case A promotor, in collaboration with seven external partners, including four technology multi-national companies, an Irish university and two research centres. The platform was initially targeted at frontline healthcare workers, as they experienced a threefold increased risk of contracting a positive COVID-19 infection, compared with the general community (Nguyen et al., 2020). The project came to a natural conclusion after 9 months in operation across multiple contexts and geographies (COVID-19 vaccine was introduced). However, this project was absorbed back into the initiating SME, and later commercialised to other contextual settings with specific diverse needs (e.g. elderly patients suffering from dementia and extreme sports settings).

3.1.2. Case B

Case B is an Irish volunteer community, also formed in March 2020, as a response to COVID-19, with the primary goal of building a community to design and develop a Field Emergency Ventilator (FEV). Three promotors initiated the 'call to action' via Twitter due to a global shortage of ventilators. Two promotors are engineers by profession, with entrepreneurial experience and the third is an academic, with an innovation management background. Within 24 hours of initiating this 'call to action', 1,500 expressions of interest from the public were received, offering assistance and providing expertise which resulted in the consortium growing to 7,000 volunteers within 1 week. This global online volunteer community, of engineers, designers and medical practitioners, collaborated to design and prototype novel, low resource/cost ventilation-based interventions in response to the COVID-19 challenge. As with Case A, this project also came to a natural conclusion after 8 months. The output of this OSI project was the design specifications of an open-source, low-cost, field emergency ventilator, available under a creative commons licence.

3.1.3. Case C

Case C is also an Irish volunteer community, formed in April 2020 with the goal of designing open-source solutions to combat challenges experienced by front-line staff, during the COVID-19 pandemic (i.e. shortage of reliable healthcare related equipment). Two promotors (a healthcare entrepreneur with a nursing background and an academic with a project management background), spun out this temporary organisation from Case B, due to a recognition of this time sensitive, yet relatively low-tech COVID-19 needs within the Irish context. The spin-out concluded after 6 months, having delivered emergency personal protective equipment (PPE) and other services to support front-line staff operations across Ireland. Across the time window, 46 sub-projects were defined, with volunteers contributing to relevant sub-projects, based on their capabilities and areas of interest. The case came to a natural end as the initial bottlenecks of the traditional manufacturing supply chains were addressed, and the pressing need ceased. Further case details are provided in Table 2.

4. Findings

In answering our research question – 'how do promotors influence OSI initiatives in response to a grand challenge?', we focus initially on how these initiatives developed and then, we explored through George et al.'s (2016) grand challenge framework, how the OSI initiative, through the promotor theory lens, was managed. Case analysis concentrated on the three core elements of this framework (1) articulations of the promotors in terms of participating in the grand challenge and their influence in formulating the temporary organisations, (2) actions development within the OSI temporary organisation and the promotor impact on same and finally, (3) exploration of the outcomes and impact that result from the actions of these OSI initiatives.

4.1. Articulating/participating

The three OSI temporary organisations had many similarities in articulating/participating in solving their specific aspect of the COVID-19 grand challenge. All promotors were highly motivated to 'do something' (Case A promotor) as 'the world was on fire' (Case B promotor). March 2020 was a period of high uncertainty, as Governments and government agencies struggled to understand the COVID-19 crisis and thus, were unable to provide answers and offer solutions. The absence of direction from

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Table 2. Case study details

	Case A	Case B	Case C
Objective	To create a wearable device	Ventilator designs	Essential healthcare equipment (COVID-19 response)
Partners	6 partners	7,000 volunteers	1,500 volunteers
Regulation[1]	Medium Risk (class IIa)	High Risk (class IIb)	Low Risk (class I)
OI Form (mode)	Strategic Alliances (coupled)	Crowdsourcing (outside-in)	Crowdsourcing (outside-in)
Promotor(s)	1 promotor – experienced SME leader in the software sector; engineering background	3 promotors (independent) – 2 promotors with engineering backgrounds working in diverse sectors (research/tech) and 1 promotor with an academic background in health; all of whom have a passion for problem solving	2 promotors (independent) – 1 promotor is an academic and 1 promotor is a healthcare specialist
Temporary organisation	March 2020–9 months' duration. SME commercialised device into new markets and geographies	March 2020–6 months' duration. Dissolved due to changes in anticipated needs/demands and in regulatory specifications	April 2020–6 months duration. Dormant due to need being addressed by traditional governmental channels
Outcome	Operational device to detect body temperature	Open-source ventilator (low cost) designs	1 million pieces of PPE delivered to hospital and case settings
Impact	Post COVID-19, pivoted to new markets and geographies and successfully executed	Creation of an OS volunteer hardware community – 7,000 members in less than 2 weeks	Creation of an open-source volunteer community motivated to contribute to an acute crisis in non-technical (albeit healthcare) ways

[1]Classification of medical devices and their route to market http://www.hpra.ie/homepage/medical-devices/regulatory-information/medical-devices-regulation/classification. Last accessed May 24th 2024.

Government, contributed to significant societal fear and panic, fuelled by extensive media coverage of quarantine lockdowns, rapid-build hospital construction and overflowing mortuaries, which contributed to a sense of 'hopelessness' (Case C promotor). All promotors held a strong sense of self-efficacy, with an action-orientated mindset, coupled with an unwavering belief in their ability to problem solve the challenges ahead.

Promotors (Cases A and B), were high-tech entrepreneurs and thus, adopted the 'technology (know-how)' promotor role – 'I felt that we had to do something technically to solve this problem. So, faced with the possibility of sitting there doing nothing versus getting engaged and doing something about it [COVID-19]' (Case A promotor). Surprisingly, the promotors deemed their lack of med-tech experience as irrelevant and unproblematic from the outset – 'we believed we could learn how to build an [FEV] or find the people who could' (Case B promotor). Allied to this, the promotors believed in the potential of OI, and this, coupled with their collaboration experience and expertise, facilitated leverage of their networks and reputations to seek like-minded organisations and individuals– 'I reached out to industry partners with an idea, people I had worked with previously and put together a really fantastic team to help' (Case A promotor).

The sense of urgency created by the acute immediacy and disruption of the COVID-19 challenge was advantageous when engaging participants since it nurtured a shared societal perspective and many individuals had time to give within their daily schedule, which helped promotors in securing participation for constructive action. Promotors embraced ubiquitous digital platforms such as Facebook, Twitter, WhatsApp, Zoom and Slack to attract the necessary resources, to structure engagement and to execute development. As actions progressed within the OSI cases, promotors constituted a management team, which provided a governance structure (especially where networks were significant) to maintain goal alignment, progress actions, promote synergy and maintain

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required engagement by demonstrating progress by the collective.

While similarities existed across the three cases, there were also notable variations. In Case A, the promotor adopted a '*power*' role due to their leadership CEO position and the unwavering commitment and resources allocated by the SME. Given their experience, industry connections, investment and long-standing credibility, the promotor was purposeful in *who* to partner with – 'my idea was to "pivot" [existing technology], so I shared this vision with my [ICT multinational] business partner… from there it started'. The promotor leveraged a bounded network of contacts and deliberately aligned with partners of comparable passion and absorptive capacity, within the ICT, healthcare, and university sectors. These purposeful strategic connections facilitated in expediting otherwise timely processes, for example, ethical approval for hospital pilot studies. Reflecting on the pace of action, the promotor emphasised the collective motivation to contribute, and problem solve since 'every hurdle was overcome through ingenuity and connections…anything we needed [to move things forward] was provided'.

In contrast, both Case B and C leveraged the global crowd, casting a wide net via both social and traditional media to recruit willing partners/volunteers. A WhatsApp message from one promotor to two peers, combined with a subsequent tweet to their collective networks and beyond, initiated the OSI process, with exponential international participation stimulated by external media attention (purposefully targeted), driving the project forward. Within days, Case B went 'viral' – 1,500 volunteers registered; 2 weeks later, this OSI initiative achieved an OS community of 7,000 active members – with diverse, yet synergistic skills. In the Case C context, the promotors initially participated in the Case B community but quickly realised that their desired outcomes differed. Promotor discussions followed and a decision was taken to spin-out Case C, with the aim of targeting more time sensitive, lower tech outputs, which was initially focused on PPE sourcing and delivery. Both cases continued to leverage the same technological platforms but operated independently, with community members contributing to the OSI initiative which best aligned with their expertise. Both communities, due to their open and voluntary nature, represented a coming together of eclectic minds, which provided the potential for democratisation of innovation practices in response to the grand challenge. While the diversity and scale of both communities was advantageous for creativity and exploration, it posed significant challenges for promotors in terms of managing engagement of individuals of different capabilities, commitment, motives and personalities.

Overall, these findings reveal the instrumental role each promotor held in initiating each temporary organisation. Each promotor's entrepreneurial capability, their action-oriented mind set, and high self-efficacy, provided the conviction to articulate, participate, initiate, and establish the necessary governance structures within the temporary organisation and in doing so, motivated others to engage and align with OSI goals. The uncertainty and immediacy of the COVID-19 grand challenge was a powerful enabler in both promoting the endeavour to a wide audience and activating the necessary resources to enable action. However, the nature of OSI recruitment was different (Case A leveraged strategic alliances with existing partners and Cases B and C were both volunteer-based open-source initiatives), influenced by the promotors background, experience, breadth of social network and technological scale of their proposed solution to the grand challenge, which influenced the OSI consortium and the governance challenge to maintain cohesion and shared goal alignment.

4.2. Actions

The three OSI temporary organisations had many similarities in terms of the actions demonstrated. All promotors executed the '*relationship*' role, that is, leveraged relationships, not only to initiate the temporary organisations to drive the necessary actions forward but also to fill structural holes in resources/capabilities that emerged during the development process. In Case B, the promotors leveraged past media experience to create a sense purpose and engender emotions of positivity and hope that actively engaged wider society – 'we knew how to use the media'. This action was fundamental in growing this crowd-based community, where critical mass was necessary to ensure availability of the 'voluntary' skills, capabilities and resources required to make progress. Equally, promotors within the three OSI cases fulfilled the '*process*' promotor role, whereby they executed each OSI vision through structuring the actions and motivating the necessary resources to commit to the temporary organisation. For example, in Case A, the promotor's vision became reality – 'we had a nexus of motivated individuals'. Technology development ensued which was creatively integrated to deliver innovative solutions, to progress and validate the necessary actions. Under these acute conditions,

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the team expedited device development in *16 days*, piloted the technological solution in a hospital setting and then extended this rollout (4 weeks later) to nursing and care homes[2] answering the additional pressures within the healthcare system. This pace of development was highlighted by participants as unimaginable in any other context and re-enforces the contribution of both promotor and aligned OSI consortium in response to the acute nature of the COVID-19 grand challenge.

All OSI cases focused on delivering medical devices (wearable temperature monitoring devices, low-cost FEVs and PPE) to support the medical frontline, but some technologies were more invasive that others and thus, the contextual setting and regulatory requirements influenced actions (i.e. development and progress) to varying degrees. In Case B, the regulatory requirements were of greatest constraint (Class 3 medical device). The promotors highlighted how, after significant progress achieved in the initial weeks, the 'sands shifted' when the UK Medicines and Healthcare Regulatory Agency (MHRA) changed the required ventilator specifications. The original vision to create a low-cost FEV, with the sole purpose of keeping patients alive, if/when hospitals experienced capacity shortages, became unviable[3] due to regulatory hurdles and potential legal liabilities. This regulatory repositioning required a pivot in the OSI objective, since the time necessary to regulate/validate the device coupled with the liability risk to individuals proved insurmountable. Thus, to maintain progress and to continue contributing to the COVID-19 challenge, the OSI objective pivoted to the development of open-source FEV designs for the developing world (available under a creative commons licence).

Cases A and C also experienced unforeseen challenges which required significant adaption and re-enforces the dynamic and complex nature of grand challenge contexts. Within Case C, the promotors struggled with the rapidly changing external context, where an 'intense yet limited window of need' existed for the manufacturing and sourcing of PPE equipment. As time passed, Government Agencies adjusted to secure reliable supply and traditional supply chains increased their capacities. These changes in the external environment influenced the priority of actions that the promotors advanced and underpinned the uncertainty of the context within which decisions were required to be made – '[Early on], this was an extremely difficult period for us. People were dying and we were deciding which hospital or nursing home needed the shipment more…they all needed [PPE], so this was hard to do' (Case C promotor).

The importance of managerial and governance systems within each temporary organisation, was crucial for effective action development with the ability to transform the potential into realised impact with respect to the COVID-19 grand challenge. Cases A and C demonstrated the importance of project management practices for structure and governance which became fundamental to *how* they operated. For example, within Case C, each sub-project had a dedicated, self-appointed PM who managed a weekly reporting agenda via SLACK including the progress, challenges, requirements etc. which provided the promotors with the necessary oversight for each sub-project. When volunteer's engagement and motivation levels '*waned*', the promotors intervened, organising 'guest' speakers to energise the team and maintain progress.

In contrast, within Case B, the necessity for management and governance was overlooked, instead facilitating a laissez faire-type process to emerge due to the vast volunteer numbers, coupled with the management challenge of varying capability levels, motives and commitment levels. This OSI project attracted attention from renowned multi-national corporations (across multiple sectors), together with independent individuals, all of whom needed purposeful, strategic management to effectively synthesise and collaborate. Issues such as lack of explicit hierarchy, the volunteer nature of participants and the scale/diversity of network engaged, challenged the governance structures in place within the case and impeded action, especially in transitioning from exploration to exploitation mode since 'too many cooks spoiled the broth… [and] we were a victim of scale and urgency' (Case B Promotor). As time progressed and actions became 'stuck in the detail', many volunteers left the community as 'external pressures returned to normality' and volunteers' ability to commit time to the initiative became constrained. Within the more tightly bounded network of Case A, the deliberate strategy, together with the significant organisational and project management experience of the contributing team, resulted in a more manageable OSI venture, which experienced less difficulty when transitioning from exploration to exploitation. In Cases B and C, the success in casting the recruitment net widely was a 'double-edged sword' in the time-sensitive era of COVID-19, since the creative potential of the resources engaged was often impeded by *noise* and disorder of the consortium scale, which ultimately resulted in goal drift, conflict and frustration, impacting OSI outcome.

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4.3. Outcomes and impact

The mission for all three OSI cases was to contribute towards the COVID-19 societal response. Whilst each case targeted specific practical outcomes (achieved to varying degree), all cases encountered challenges in achieving the desired impact – such as changes in the FEV regulatory specifications (Case B), unknowns become known, for example, anticipated demand for FEVs did not materialise and regulatory specifications changed (Case B) and the ongoing efforts of the Irish Government to relieve the pressure for PPE (Case C). Similarly, in Case A, the introduction of COVID-19 vaccines eliminated the urgent need for temperature screening devices. On reflection, the greatest impact across the cases was the positive psychological action of doing and the emergent learning resulting from this doing action. In each case, the promotors harnessed societal goodwill, providing hope during a dark uncertain time – 'we gave people a sense of purpose and achievement [during lockdown number 1], we offered something positive for people to do, a place to go [online community]' (Case B promotor). For all volunteers involved, these OSI initiatives provided a much-needed sense of belonging and community (Barcomb et al., 2018), together with the opportunity for positive action 'rather than binge watch another boxset on Netflix' (Case C promotor). However, given the complexity of the context, the enormity of the grand challenge and the myriad of unknowns, one could argue that the original objectives were unachievable and perhaps naïve 'when the MHRA regulations changed, the complexity bar tripled, and we knew we couldn't do what we set out to do' (Case B promotor). Yet, it was the 'magnificence' of the ambitions of these OSI initiatives that attracted so many to commit to these temporary organisations and contribute to deliver positive solutions when need was the greatest.

Reflecting on these outputs, Case A has successfully '*pivoted*' existing technology into a new medtech device, serving two new customer segments in different markets, proving commercially advantageous for the championing SME. Case B has made available 'open source' designs for the low-cost field emergency ventilator on the internet, should it be required by any developing country (Case B promotor). Finally, Case C nurtured and developed a network of PPE producers and distributors that supported front-line hospitals and care homes during that first COVID wave. While OSI consortia proudly highlight their operational achievements, it is perhaps their processual achievements that is most laudable. All three cases demonstrated that OSI is achievable through harnessing diverse/independent capabilities within a community committed to a common objective under severe time-constraints, at least within the explorative phase.

The findings highlight that the OSI progression of actions and their ultimate impact is dependent on the network governance and project management, equal to the technical expertise. Thus, it is the human rather than the technological factors that often are the greatest impediment to positive outcome and impact. For example, in Case B, as time progressed, locus towards a 'core group' occurred which enhanced communication and progress from the exploration phase where 'idea-generation ruled' to the exploitation phase of delivering impact. However, attrition of the community also occurred, which influenced ability to deliver ambitious outcomes and ultimately shortened the 'life' of the OSI project. Given that participation was based on goodwill, many participants 'pulled back' from previous engagement levels as work life returned to some normality 'the management structure wasn't there, [people] guidance element was missing….we (promotors) were busy trying to solve the problem at hand [ventilator spec challenge] which led to well-meaning, less competent individuals tapering off, when there wasn't somebody there to tell them what to do' (Case B promotor). This resulted in reduced OSI progress, partially due to the emerging capability gaps as people disengaged from the process and subsequent demotivational impact on those remaining committed, feeling under increased pressure to achieve their objectives.

While some OSI's original goals may have eluded their consortia's best efforts, many indirect benefits for society were experienced. In Cases B and C, these projects spurred-on government and industry stakeholders to action, through the promotors positive mindsets and actions 'there was a time in April, 2020, our PPE delivery was the only delivery into the [Irish] hospital system until the [Irish health government agency] acquired PPE' (Case C promotor). Case B also inspired contributions and action from many industry players to enter the area, '[multinational satellite company] were inspired to work on ventilators because of our initiative, and that is something to be very proud of' (Case B Promotor). Despite the difficulties encountered, all promotors remain positive towards the future leverage of OSI to contribute towards grand challenges and viewed *bottom-up* OSI initiatives, not in competition with Government but complementary– 'it is OK for governments to ask for help. Governments need to change how innovation is conducted and we proved how to leverage OSI for societal benefit…. We found a way of bringing "like-minded individuals" together to create a rapid iterative innovation process. It is possible'. (Case

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B promotor). Whilst remaining positive about the impact, Case C promotor highlighted the significant barriers advancing a bottom-up approach, especially within highly regulated sectors 'in hindsight, we could never solve some of the larger governmental challenges, but we endeavoured in good faith'. To resolve this, the promotor advocated for increased integration of the top-down with bottom-up initiatives to provide effective structure and longevity for future OSI initiatives to flourish and deliver on grand challenges.

Overall, the findings revealed the positive societal impact each OSI initiative realised through the leverage of OI approaches in response to a time-sensitive grand challenge. Delving deeper into the promotor perspective, the research highlights how the outcome of each OSI initiative differed due to this 'human' perspective, with the role each promotor fulfilled within the project, influencing consortium actions and eventual outcome. Factors such as the promotor's credibility and industry experience motivated and influenced participants to contribute to the grand challenge; promotors provided the capability to facilitate managing each OSI project, addressing emerging conflict and remaining aligned with a rapidly evolving dynamic environment. Table 3 provides details of the promoter role and promotor characteristics within each case that impacted the OSI case and the temporal organisation by which it was developed.

5. Discussion and concluding comments

This study responds to the call for continued learning from OSI initiatives in reaction to the grand challenge context (Di Minin et al., 2021; Mortara et al., 2022). Through reflection of the role of the promotor across the development of three cases, this research deepens our knowledge of the OSI process, especially regarding how promotors' interventions may influence OSI capability and impact the complex context of addressing grand challenges.

This research exemplifies that OSI has the capability to contribute towards addressing grand challenges. Through harnessing the power of technology, the promotor in leveraging the OSI process, enables co-ordination of motivated, diverse individuals and societal resources, to generate novel solutions (Bertello et al., 2022). OSI potential is driven by uncertainty and urgency due to the emergence of the challenge, stimulating both broad societal unity to act and empowering passionate leaders to initiate, guide and co-ordinate the masses in action (Kohler and Chesbrough, 2019; Füller et al., 2021). The collective cases highlight the human element of OSI (Ahn et al., 2019), that is, promotors centrality, decision-making and structural influence across the lifecycle of each temporary organisations to deliver positive outcome (Fichter, 2009). Each case highlighted the promotor's OSI challenges in terms of the *crowd* scale of action, coordination challenge, goal alignment and outcome realisation (Füller et al., 2021). A recurrent theme was the recognition of an OSI bias towards creativity and exploration rather than exploitation and implementation. Case evidence provided insights into how promotors struggled to maintain momentum in the transition from exploration to exploitation mode.

The research findings also highlight the optimal time-window for OSI initiation, whereby motivated promotors translate a need, leverage their power and harness the willingness of the wider network to drive positive action. Once time passes, the opportunity for initiating and maintaining OSI initiatives declines as a new normality is established. Based on this, one could argue that OSI will be more effective in both initiating and maintaining action relative to sudden and unexpected grand challenges (e.g. recent pandemic), as opposed to more gradual and persistent grand challenges that are deteriorating over time (e.g. climate change). To address this gap, an exploration of the role of Government, regarding how they might provide the necessary co-ordination resources to support ongoing contribution of multiple, independent, bottom-up OSI networks that align with a central grand challenge, would be advantageous and establish a 'participatory architecture' (Ritala, 2024) where meaningful engagement and long-term impact could be achieved. The structure of such an architecture would support networks to scale in the early stages of formation and avoid certain governance pitfalls that may impede OSI actions and outcomes at points along the process. Furthermore, the inclusion of commercial enterprises as a potential partner or the leverage of OSI networks as 'lead user' (Von Hippel, 2006) communities by industry stakeholders may support OSI in transitioning from exploration to the exploitative phase of the OSI process and thus enhance impact for society advantage.

This research reinforces the importance of the unique sectoral context and the complexities in managing the multiplicity of OSI participants. The healthcare context of the three OSI cases studied, highlights the necessity of alignment with regulatory requirements and stakeholder standards (hospitals, care homes, medical staff, universities etc.) as 'order qualifying criteria' to nurture collaboration, address legal liability and nurture market adoption into the future. Such promotor industry knowledge facilitates the OSI path towards delivering the desired societal

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Table 3. Promotor role and characteristics by case study

Grand challenge phase	Promotor role (power/technology/process/relationship)/characteristics
Case A	
Articulations/Motivations	• **Power** – respected industry leader (technical background/management experience). • **Technology** – strong desire to '*do something*' in response to COVID-19 grand challenge motivated the pivot [of existing device] to save lives. • **Relationship** – top-down influences to motivate others to contribute (both internally and externally – multi-nationals/university).
Actions	• **Process** – meticulous planning and project management – fully functional device in 16 days. • **Relationship** – long standing relationships with external multi-national partners which sustained the project.
Outcomes/Impact	• **Process** – 'Entrepreneurial hustle' demonstrated – '*opportunity*', '*resources*' *and* '*learning*' • **Technology/Relationship** – successfully executed and operationalised device post COVID into new markets and geographies
Case B	
Articulations/Motivations	• **Technology** – leveraged engineering 'know-how' and understanding to initiate OSI community. • **Process** – influenced others and tried to simplify the complex processes of a med-tech device. Strong desire amongst promotors to 'give back'. 'Entrepreneurial hustle' – hustled for '*opportunity*', '*resources*' and for '*learning*'
Actions	• **Process** – set ground rules for engagement to focus on output (i.e. designs/product), do not take money, share learnings, no infighting, facilitate collaboration. • **Relationship** – strong reputation within tech sector, viewed this an opportunity to influence and engage others. Media and PR experience – the promotors were experienced at how to navigate the media and receive positive attention.
Outcomes/Impact	• **Relationship** – found a way to bring '*like-minded individuals*' together '*to create a rapid iterative innovation process*' *and* '*fastest growing volunteer hardware community in the world*'. • **Process** – project learnings – 'how' best to **manage** a volunteer community; deeper understanding of problem needed, that is, (low cost) field ventilator – not as simple as first thought; governments '*could/should ask for help*', that is, to leverage volunteer communities for grand challenges.
Case C	
Articulations/Motivations	• **Technology** – know-how and understanding of unmet clinical needs – *'patient centred*' and '*needs driven*' innovation at the core of OSI. • **Relationship –** leveraged OSI community contacts to participate
Actions	• **Relationship** – influenced others – internally within the volunteer community and externally with collaborative partners – universities/maker spaces/global partners to source and deliver essential PPE; promotors organised 'guest' speakers to energise and enthuse the team. • **Process** – embedded project management practices; leveraged experience.
Outcomes/Impact	• **Process** – 1 million pieces of PPE delivered to hospital and care settings; OSI learnings – team did not have the capacity to follow through on many sub-projects due to resource deficits and conflicting demands; OSI community is now 'dormant' (after 6 months operation) but strong belief that there is an opportunity to revive OS community for future grand challenges.

benefit. For OSI's within unregulated sectors, factors other than regulatory alignment will come to the fore and require an awareness by promotors. We will now explore the theoretical and practical contributions.

5.1. Theoretical contributions

Adopting George et al.'s (2016) grand challenge framework, we explore how through adopting the promotor theory lens, the OSI can be more effectively managed in response to future grand challenges. The promotor is fundamental to the realisation and trajectory of OSI (Ferraro et al., 2015). Within each temporary organisation, the promotor takes on various promotor roles evident within the literature, namely power, technology, process and relationship (as illustrated in Table 3) to advance the OSI objectives. First, the *power* role is assumed by virtue of the

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promotor's leadership position and influencing power (Witte, 1977) and this role is further revealed by the promotor's ability to priority resources and seize the risk. The power promotor role manifests differently depending upon whether the managed network is bounded or open in nature, with the challenge of maintaining cohesion and control being greater in voluntary networks. Second, our evidence highlights the *technology* promotor role, exemplified in their know-how, background and experience (Hauschildt and Kirchmann, 2001) and leveraged it to underpin their problem solving capabilities required across the OSI lifecycle. Third, the *process* promotor role is evident by virtue of the promotor's leadership position within the network, and their role in determining the management routines and governance systems that will steer OSI behaviours into the future, influencing the longevity of the network (Hauschildt and Kirchmann, 2001). Finally, and arguably most importantly in the OSI context, the *relationship* role (Pemartín et al., 2019) was core in achieving cohesiveness of purpose across the network, addressing conflicts and securing resources to maintain progress towards addressing the grand challenge. Promotors leverage their personal and professional connections, together with industry reputation and commitment to execute on OSI action and achieve impact.

This study responds to the call from Howard-Grenville (2020) to '*theorize the arrows*' within the grand challenge framework (George et al., 2016). As outlined earlier, this is achieved through the lens of promotor theory (Witte, 1977) and an exploration of the relationship between each element of the framework. The case study promotors adopted distinct promotor roles at different grand challenge phases, all of which was dependent on their underlying characteristics, that is, experiences, backgrounds and knowledge (see Table 3 for further case details). In essence, all promotors were driven by an altruistic desire to contribute towards addressing the grand challenge. At the articulation/participation phase, promotor leveraged their positions and technical know-how which resulted in the creation of positive outcomes/impacts. Inherently, this study demonstrates the role that promotors, through leveraging their background, knowledge and experience, can play in initiating OSI communities to respond to grand challenges. However, while promotors may perform well at the early participation (i.e. initiation) phase, the advancing of actions and realising impact poses specific challenges, in part due to the complexity and scope of grand challenges, but also due to challenges of securing necessary resources and maintaining impetus across the volunteer consortium as time passes. Thus, we posit that assistance from government or commercial entities is a necessary ingredient to exploit and effectively co-ordinate such OSI endeavours over the long term, to achieve consistent and meaningful contribution.

5.2. Practical implications

This study has implications for future promotor OSI roles within temporary organisations directed at societal grand challenges. The initial decision to promote and pursue OSI in temporary organisations should be carefully considered as it is a challenging, albeit rewarding endeavour. As this study highlighted, to successfully manage such temporary organisations, promotors need to be cognisant of many factors, such as the centrality and credibility of the promotor within their respective networks, the promotor's experience and knowledge of OI (McGahan et al., 2021), experience of project management practices (Füller et al., 2021), their ability to leverage ICT, digital and media platforms for project promotion opportunities (Barcomb et al., 2018) and also their ability to lead, motivate and unify voluntary consortia to commit to the cause (Fichter, 2009).

The results of this study also have implications for public policy directed towards supporting OSI initiatives. The empirical evidence in this study highlighted how promotors, meaningfully '*attacked*' the COVID-19 grand challenge, through harnessing the goodwill, generosity, and creative capability of existing partners (Case A) and *crowd* volunteers (Cases B & C). Given the scale of present and future grand challenges facing society, this study has demonstrated the necessity for government to fulfil an overarching coordinating role of *orchestrator* of a 'participatory architecture' (Ritala, 2024), meaningfully supporting promotors in their efforts, through various support structures and mechanisms to enable OSI initiatives to achieve the meaningful engagement, collective learning and long-term impact towards specific grand challenge objectives. The case studies highlight how OSI nurtures rapid development but also democratises grand challenge innovations, allowing motivated individuals to translate need into action, thus engaging in positive action. In the past, addressing grand challenges was the sole remit of entities such as multi-national organisations and large philanthropic funds, in collaboration with Governments but the future is one where top-down and bottom-up perspectives will co-exist and meaningfully interact synergistically, in response to grand challenge pressures.

5.3. Limitations and further research

This study was limited to three OSI case studies based in Ireland within the healthcare context. The

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Irish healthcare context has many challenges (e.g. overcrowding and resourcing), some of which are unique to Ireland. Future research should seek OSI research opportunities in other contexts and geographies. Time has passed since the peak of COVID-19 crisis; however, innovation management scholars have a responsibility to *deep dive* into OSI initiatives to reveal what has worked versus what has underperformed, in order to share the learnings for the benefit of future grand challenge responses.

Acknowledgements

The authors would like to thank the research participants for their participation in this study. The authors are grateful for the valuable constructive feedback received from the reviewers and editors. Open access funding provided by IReL.

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Notes

[1]Promotor in this context.

[2]Half of all COVID-19 deaths in Ireland were within care and nursing home settings, so there was an immediate urgency to address the needs of this vulnerable group.

[3]Seventeen product iterations were completed within a 6-week timeframe.

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