How to Evaluate Managerial Cognition and Avoid Traps in Open Innovation

Hardik Bhimani
RMIT University

Anne-Laure Mention
RMIT University

Dimitrios Salampasis
Swinburne University of Technology

Organisations find it difficult to assess 'purposeful' knowledge sourcing and sharing (KSS) for open innovation (OI), limiting full potential of KSS. We present thematic insights from 22 cognitive interviews with OI managers exploring their beliefs, perceptions, and actions during KSS activities and propose a practical framework by aggregating perception and knowledge of best practices. With illustrative quotes, a practical example case, and visual cues, we situate discussions on the common OI traps and provide clear implications for managers and organisations contemplating engaging in OI. We hope our framework provides new insights and pathways at the OI-cognition nexus.

Keywords: engagement, managerial cognition, open innovation, personal agency, framework

OPEN INNOVATION IS A COGNTIVE CHALLENGE

The goal of knowledge sourcing and sharing (KSS) activities in open innovation (OI) is to recognise synergies; identify, assimilate, and use new knowledge; and deliver outputs beyond the reach of one organisation (Bogers et al., 2018; Chesbrough, 2020). To avoid missing out on additional capabilities to create new solutions, increase profit and accelerate time-to-market, organisations may engage in OI in a haste (Chesbrough et al., 2018; Dahlander and Wallin, 2020). We argue that this in part due to organisations setting up OI initiatives without fully understanding the implications of *managerial cognition* – the cognitive schema, structure, or orientation of a focal manager (Manral, 2011; Stubbart, 1989). For instance, in the popularised case of failed OI at ElectriCo (von Briel & Recker, 2017), the assumption was that simply providing a platform and a culture for innovation would be enough to extract desired value from OI.

Benefiting from OI is a much more complex and often paradoxical process than organisations frequently assume (Frishammar et al., 2015). On the one hand, heterogeneity of knowledge and capabilities between partnering organisations creates potential for value creation, through increased reach, sharing of costs, reduced commercialisation risks and increased speed of development. On the other hand, engaging in OI creates challenges for intellectual property rights, search for suitable partners and absorption of new knowledge from several sources (Laursen and Salter, 2006; Ritala and Stefan, 2021). Thus, even when organisations have adopted OI, the degree of openness in KSS, measured for instance by the number and

types of knowledge partners, is often constrained (e.g., Vahter et al., 2014). Besides, false perceptions of KSS value are not uncommon in practice and have at times led to legal battles. More recently, in a large-scale survey, Brunswicker and Chesbrough (2018) found that 2.5% more managers had closed OI initiatives than their previous such study, with nearly 50% of the participants reporting unsuccessful OI projects. Their findings revealed that disengagement in OI stems from managerial perceptions of KSS in OI as being "too risky", "too difficult" and "too expensive" (p. 35). As such, OI is beset with cognitive challenges (Frishammar et al., 2015). Where the collective knowledge may be of value to the joint project, new ancillary knowledge can unexpectedly sow seeds to solve another problem. The serendipity of this value discovery takes managerial cognitive effort (de Paula et al., 2023), yet if properly recognised could help reposition partnering organisations and restructure knowledge flows, leading to additional value capture opportunities (Granstrand and Holgersson, 2014).

WHY EVALUATE MANAGERIAL COGNITION IN OI?

OI literature emphasises the notion of *purposive* KSS (West et al., 2014). Purpose, however, relies on key individuals' perception and cognition (mental schema) to bring the promise of OI to fruition. These key individuals (OI managers) are often responsible for recognising new knowledge and evaluating external knowledge for its creativity and usefulness potential. They are also involved in facilitating organisational-level engagement in OI and maintaining multi-actor relationships across the innovation networks. Through assimilation and transfer activities, OI managers integrate and promote useful knowledge to facilitate development of new products, services and markets. However, such boundary crossing KSS activities are challenging and give rise to knowledge-leveraging paradox (Ritala and Stefan, 2021).

Perhaps, a turning point in OI literature is the focus on failed cases, often citing withdrawal from KSS (Ciesielska, 2018; Hewitt-Dundas and Roper, 2018; von Briel and Recker, 2017). Fortuin and Omta (2008) surveyed 32 managers from 12 failed inter-company collaborations and found that soft aspects (e.g., fear, distrust, perceptions of uncertainty) were more difficult to handle than technological (hard) aspects. Ciesielska (2018) explored the case of Nokia and found that failures in the journey from closed to OI highlighted managerial inability to engage external contributors and develop trust which led to implementation of an unclear model for collaboration. Likewise, in a study involving micro businesses, Hewitt-Dundas and Roper (2018) attributed OI failures to lack of understanding of potential benefits, capabilities and trustworthiness of potential partners. To attain desired goals from OI, organisations need to ensure that managers realise that the locus of innovation may be outside the organisation and 'self'. A key challenge for organisations is also to rein in the OI managers' urge to engage in KSS that arises from exorbitant competitive pressures, stakeholder requests and aggressive internal innovation targets. Thus, organisations must take the time to diligently evaluate OI managers' cognition and agency (beliefs of own abilities) to assess the potential of each KSS opportunity in OI. Current OI literature provides organisations with limited insights into how to do this precisely.

So far, literature has limited this exposure to individuals' attitudes, absorptive capacity and coping mechanisms (e.g., Enkel et al., 2017; Hannen et al., 2019; Yildiz et al., 2021). These studies highlight the role of individuals' attitudes towards KSS, their ability to absorb new knowledge and cope with changing job-roles as the organisation adopts OI. A key feature of these studies is the focus on individuals' subpersonal cognitive processes (e.g., heuristics, see Antons et al., 2017). Other studies have investigated how individuals' orientation towards learning from new knowledge (Yildiz et al., 2021) and differences in thinking style (e.g., bisociative thinking) can affect their ability to recognise, assimilate, transform, and exploit knowledge from others, which in turn can affect organisation-level OI practices (Lowik et al., 2017). Recent recommendations of tacit-codified knowledge separation, selective revealing and use of protection mechanisms by Ritala and Stefan (2021) signals organisational-level remedies but are limiting to understand how organisations can precisely manage OI managers' external KSS cognition. While organisations operationalise KSS activities once an OI contract is signed, often cognitive challenges exist with elements and processes related to how value is perceived and abilities are employed in KSS activities, many of which are outside the control of the organisation (e.g., differences in cultural economies, see

DeFillippi et al., 2007). This complexity, if not evaluated early, compounds risk during OI engagement because small lapses in managerial conceptualisation and use of KSS can cascade into serious loss of value from OI engagement, eventually leading to failure. When conceptualised as knowledge-leveraging paradox in reference to value creation and capture as two poles of OI, Ritala and Stefan (2021) propose that individual perceptions of ambiguity of innovation-related knowledge create transferability (problems with absorption and assimilation) and exposure tensions (due to fear of opportunism and misappropriation), which in turn limits the realisation of value creation and capture potential in OI. At a managerial level, this translates to challenges in assessing KSS opportunity and directing goal-oriented actions to attain desired OI objectives. This managerial-level understanding of KSS in OI (e.g., Natalicchio et al., 2018) is relevant because OI managers often differ in how they perceive and respond to KSS challenges, and these cognitive responses impact managerial behaviour and actions supporting KSS activities in OI (Ritala and Stefan, 2021).

Of importance here is the notion that individual OI managers are self-influencing agents. They can influence KSS in OI through their thoughts and actions; just as they are influenced by the environmental context in which they operate. Through mental processes of acquiring, storing, retrieving, transferring, and reusing knowledge, OI managers know and develop the ability to engage in purposeful KSS in OI. Perception of value in KSS in OI is thus intrinsically linked to managerial cognition, stored as justified information in memory. Unless there is purposeful KSS at individual-level, there may not be purposeful knowledge flows at an organisation-level. In this view, our conceptualisation complements recent scholarly interest on the role of 'mindset' in OI (e.g., Engelsberger et al., 2022; Gomezel and Rangus, 2018; Salampasis et al., 2015) and draws attention to personal agentic capabilities beyond the power of attitudes. Furthermore, relying merely on mindset (or organisational mechanisms and structures for that matter) runs the risk of overstating its influence on individual outcomes, driving attention to short-term frames of reference and performance instead of long-term goal-oriented learning (e.g., Bjork and Bjork, 2011; Dweck, 2015). Besides, individuals' mindset may not effectively translate to their roles without integrating it into selection and contextual training (Crane, 2022). This is because as self-influencing agents, OI managers will always experience tensions related to knowledge-leveraging paradox differently. OI managers are not born with pre-determined mindsets or attitudes towards KSS, rather their cognition and beliefs of own abilities are learnt through interactions with the environment and lived experiences. Indeed, recent longitudinal study have shown than managers develop their cognitive capabilities through experience, sense of direction in search of a novel solution, interpersonal relationships, and sense of timing in opportunity recognition (Walsh et al., 2022).

STUDY APPROACH

This study, which is part on a research project that has operated for more than three years, identifies traps related to managerial cognition inherent in OI. We build on our previous work (citations removed for blind review) and offer insights into how organisations can improve the way they evaluate KSS opportunities in OI. Based on theoretical thematic coding and pattern matching of data from cognitive interviews (CIs) with 22 OI managers from Australia, Europe, and USA (See Table 1), we develop a three-phase managerial cognition evaluation framework with actionable steps and questions for organisations to consider before engaging in a KSS opportunity in OI.

Specifically, we selected these interviewees based on their roles as key individuals driving and managing external KSS activities in their organisations. A purposive sampling with snowball approach was used to isolate known OI managers in the emerging OI community. Our research focused on the key managerial cognitive conflicts and discrepancy reduction processes. In turn, this unveiled managers' perceptions towards value of KSS in OI, key challenges they faced in bringing OI to fruition and beliefs about own abilities that helped them reach desired goals. Some of our interviewees described positive beliefs towards KSS in OI, some did not, and some remained uncertain of its value. Thus, a mix of perspectives were captured. Based on CI techniques, often used to extract witness testimonies in courts, we gathered detailed accounts of how the interviewees' organisations engaged them in their roles, how their

functions were perceived and evaluated by others and how did they organise their beliefs and actions before, during and after engaging in a KSS activity in OI. The primary rationale for adopting this methodological strategy is that interactions and exchange in purposively managed knowledge flows are neither accurate, nor sufficiently specific and require an effort to search, assimilate and interpret connections across situational and decision-making contexts to unveil the often-hidden cognitive abilities of OI managers influencing their perceptions and behaviour towards KSS in OI. CI approach not only helps to elicit more information, but also helps minimise misinterpretation, drawing accurate information by facilitating memory search and retrieval (Fischer and Geiselman, 1992). We drew their attention to specific and recent OI initiatives to maximise potential of the employed cognitive retrieval techniques (e.g., think aloud). We first analysed responses of 6 interviewees, a number usually associated with sufficiency when using CI techniques (Gieselman et al., 1985). We employed theoretical thematic coding with pattern matching, a systematic way to code, categorise and relate emerging themes from a complex data set to constructs found in literature (Braun and Clarke, 2006). Finally, we mapped the patterns based on theoretical understanding to develop a draft framework to evaluate managerial cognition towards KSS in OI. By adopting a validated learning approach, the draft framework was gradually adjusted in line to the information that emerged from the interviews.

TABLE 1
STUDY PARTICIPANTS, THEIR JOB TITLES AND EXPERIENCE IN OI

Case	Job title	In-role focus	OI experience (in years)
P1	Board Member/Chairperson	Decision maker	10-15
P2	Director, Open Innovation Networks	Decision maker	5-10
P3	Acting Chairperson	Knowledge broker	Less than 5
P4	Open Innovation Project Manager	Gatekeeper	Less than 5
P5	Global Leader – Innovation team	Decision maker	5-10
P6	Principal, Open Innovation	Decision maker	Less than 5
P7	Head of Innovation and Technology Advisory	Decision maker	More than 15
P8	Innovation and research co-ordinator	Knowledge broker	Less than 5
P9	Managing Director and Chief Innovation Officer	Decision maker	5-10
P10	Senior Open Innovation promoter	Knowledge broker	Less than 5
P11	Senior Innovation Manager	Gatekeeper	Less than 5
P12	Senior Project Manager	Gatekeeper	5-10
P13	Head of Innovation and Strategy	Decision maker	Less than 5
P14	Head of Open Innovation	Decision maker	5-10
P15	Director, Open Innovation	Decision maker	More than 15
P16	Open Innovation Manager	Gatekeeper	10-15
P17	Chief Executive Officer	Decision maker	10-15
P18	Co-founder/Creative Director	Knowledge broker	5-10
P19	Head of Ecosystem Engagement	Decision maker	5-10
P21	Senior Innovation Manager	Gatekeeper	5-10
P22	Head of Quality and Environment	Decision maker	Less than 5

OPEN INNOVATION TRAPS

Due to competition, urgency, and fear of missing out, the OI managers we interviewed often adopted a high-risk, all or nothing approach to OI. This approach can get desired innovation traction, but the push can also lead to OI overreach – engaging in OI without appropriate evaluation of managerial cognition and beliefs of own abilities to harness value from boundary crossing KSS activities. As our research highlights, the lack of managerial cognition evaluation leads to failure to exploit full potential of KSS opportunity in

OI. We found that these failures relate to three OI traps, which were common across all interviews (See Table 2):

TABLE 2
THREE OI TRAPS RELATED TO MANAGERIAL COGNITION TOWARDS KSS

OI traps	Key themes
Trap 1: Pushing out an OI initiative without understanding the OI manager's cognition towards KSS value	OI managers often too optimistic about solving innovation problems through external KSS
	OI managers finding it challenging to understand specific requirements of partners and other stakeholders' desires and needs
	Lacking ability to critically evaluate own beliefs on KSS value in reference to in-role functions
Trap 2: Promising additional gains from KSS in OI without understanding OI manager's personal agency towards KSS in OI	Lacking appropriate autonomy in in-role KSS functions for extracting desired value
	Overlooking influence of powerful stakeholders in shaping variations to OI manager's ability to extract value from opportunity
	Ability to manage cognitive conflicts emerging from role conflict and perceptions of others in KSS activities
Trap 3: Getting sold on KSS opportunity in OI without understanding the OI manager's agentic cognitive capabilities	Inadequate understanding of ability to recognise useful tangential knowledge emerging from core KSS activities
	Selective cognitive processing of learnt experiences for evaluating own abilities to harness value from boundary crossing KSS activities
	Misjudging ability to recognise, monitor and control own cognition and affective states in evaluating KSS opportunity in OI

Trap 1: Pushing Out an OI Initiative Without Understanding the OI Managers' Cognition Towards KSS Value

In their rush to exploit a KSS opportunity, OI managers may not appreciate specific requirements of the knowledge partners and related stakeholders that they need to fulfil. A small chemical company's Chairperson [P1] described how he eagerly pursued and promoted KSS opportunities to develop a new product, without clearly understanding how the solution would deliver on the priorities of project sponsor. Guided by self-influencing pressure to pursue a novel solution to known problem, he invested in the knowledge partner's ambitious OI contract. The initial KSS push failed miserably to understand the required extent of value creating KSS activities to meet OI goals, namely efficiency gains and enhanced user experience. As a result, the chairperson had to go back to initial conceptualisation of the problem and redirect efforts to procuring useful knowledge from relevant stakeholders, at a cost to valuable resources and cognitive efforts.

A related concern is that stakeholders can diffuse expectations of value in KSS in OI because they cannot clearly articulate their innovation requirements and OI goals. This coupled with OI managers' limited ability to critically evaluate own beliefs on KSS value in reference to their in-role functions, can lead to OI manager engaging in KSS without understanding its organisation-level value creating potential. One head of OI we interviewed expressed frustration after finding a KSS opportunity with a start-up organisation to develop new product after months of scouting. In essence, the head of OI invested efforts as part of their in-role function to identify and recognise a KSS opportunity, when the influencing

stakeholders did not value it. "*Probably if you're embarking on something, you would quite like to get a quick win quickly, so that you can influence up and say, 'This is why we're doing it.' - quite frankly if people don't start to look at things like open innovation, you know, technology is moving at such a pace that, they will wither and die*" [P14].

Trap 2: Promising Additional Gains From KSS In OI Without Understanding OI Managers' Personal Agency Towards KSS In OI

OI initiatives get launched with promises of value creation from collaboration and purposive KSS, but without clear understanding of OI manager's personal agency (beliefs of own abilities) to attain desired goals. For example, a multinational finance organisation launched a new OI initiative to develop new product, without appropriate role autonomy for the innovation and research coordinator, and alignment of their in-role functions to achieve an ambitious KSS pursuit.

When engaging in KSS opportunities in OI, organisations need to reconsider and reconfigure OI managers' in-role functions. We found OI managers faced increasing cognitive conflicts because of role conflicts (what they believed and what the job required them to do) and misaligned perceptions of knowledge partners as distant from self (both physically and cognitively). Personal agency challenges range from dealing with multiple knowledge partners, make sense and assimilate new knowledge to cognitive efforts in managing value delivery process. A valuable KSS opportunity may fail because the organisation is yet to understand OI managers' personal agency towards KSS for value creation and capture in OI. In such cases, outcome is a severely limiting extraction of value from KSS activities. A creative director at an art curating organisation who was working with a powerful stakeholder said "*we went back to our own comfortable space. And we drove on - we had someone above everyone else. So, it didn't matter what anyone said between us and him…he's like, 'This has to happen and we're gonna do this. Do it*.'" [P18]

Trap 3: Getting Sold on KSS Opportunity Without Understanding the OI Managers' Agentic Cognitive Capabilities

Organisations often fail to fully consider that OI managers are self-influencing agents. Lack of OI managers' understanding of own cognitive abilities leads to mistaken engagement in OI initiatives, as well as flawed perceptions of value creation and capture potential of KSS opportunity. OI managers act on the premise that they can create desired value by exerting effort towards recognising, assimilating, and using new core knowledge from KSS activities. Because new core knowledge tends to be specific to joint OI project, it may offer limited scalability unless OI managers' abilities to exploit emergent tangential knowledge is explicitly understood from inception. To realise full potential of OI, organisations need to understand OI manager's abilities to recognise knowledge about self and others behaviour in exploiting KSS opportunity, knowledge about how to extract value from KSS interactions, and understanding of when to apply learnt knowledge.

Likewise, when organisations rely on OI managers' estimation of value in KSS in OI, they may be unable to appraise the full range of possibilities. Some value may be obscured in OI managers' selective cognitive processing as they often strive for positive identity of self-in-role. Other possibilities may be vague as OI managers overestimate and/or trivialise own abilities of managing cognitive conflicts to preserve their preferred self-in-role. According to a director of OI at a multinational manufacturer, "*like somebody said if you are open for everything you cannot be tightening the door. But that resonates, and it has to do with a little fear*." [P15]. We provide an example of how a digital technology provider to art industry encountered these traps in an industry revolutionising OI project (Appendix A).

A FRAMEWORK FOR EVALUATING MANAGERIAL COGNITION TOWARDS KSS OPPORTUNITIES IN OI

We found that organisations employed unstructured and often ad-hoc approaches to understand OI managers' cognition and abilities to create and capture value from KSS in OI. Once an OI initiative gets a strategic go, organisational focus is often on setting up structures of collaboration, initiating dialogue with

potential partners and driving institutionalised OI culture. Amidst the rush OI managers are somehow left to fend for themselves, navigating scenarios in which they need to be the champions and learn about being a champion simultaneously. As the head of innovation strategy at a sports technology company described, "*when you were positioned as the head of R&D, you had to deal with this open innovation concept. What do you see had happen outside your firm for you to actually say, Okay, yes? We will go to the crowds for this one or what were you looking out for? – this was the most challenging.*" [P13]

Aggregating findings from our research, we propose a three-phase managerial cognition evaluation framework that can help organisations improve value creation and capture potential from KSS in OI (See Figure 1). The phases encompass six sequential steps which unfold as a KSS opportunity in OI is evaluated, with the ultimate purpose of reaching an informed decision. Although the phases seem exhaustive, organisations may need to employ the framework over iterative rounds to evaluate the potential of a KSS opportunity. Of relevance will be the use of framework before embarking on OI initiative, at a mid-point and in retrospect. In the next section we describe each phase and key questions for organisations to consider in reaching a go/no-go towards KSS in OI (See Table 3).

FIGURE 1
IMPLEMENTING THE MANAGERIAL COGNITION EVALUATION FRAMEWORK FOR KSS OPPORTUNITY IN OI

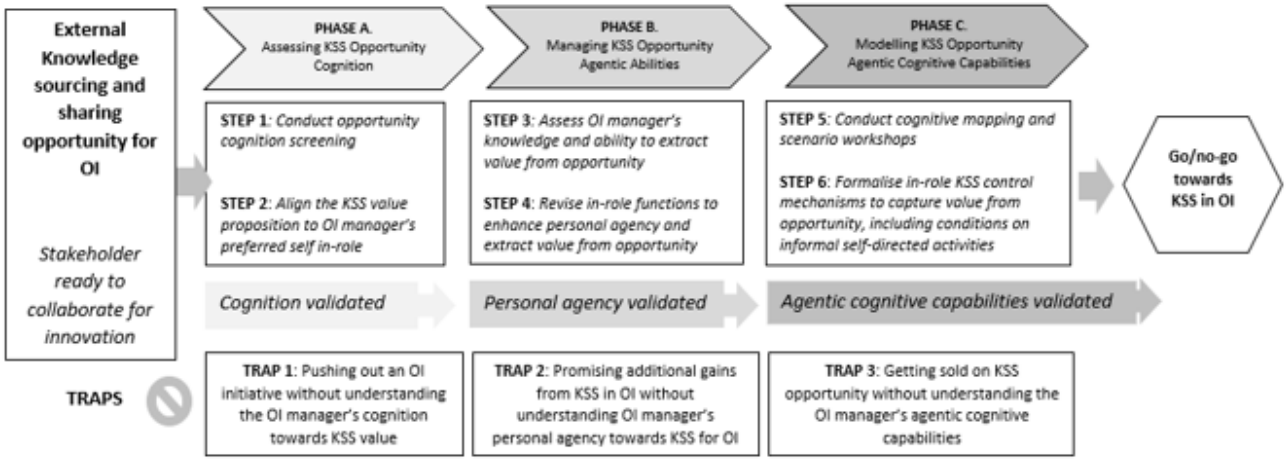

TABLE 3
IMPLEMENTING THE MANAGERIAL COGNITION EVALUATION FRAMEWORK FOR KSS OPPORTUNITY IN OI

Phases	Steps	Questions to consider with OI manager	Approaches to consider with OI manager
Phase A: *Assessing KSS opportunity cognition*	1. Conduct opportunity cognition screening	• What perceived need(s) can be solved through KSS? • Who is and/or needs to be part of the value creation process? • What are the hidden needs and motivations of others in wanting to engage in KSS for OI? • Does the OI manager have a clear understanding of how KSS will work?	• Techniques such as Think-Aloud that can help identify and recall information (e.g. define the opportunity, describe the process, what is the main idea of KSS, etc.) • Providing facts and supporting information with KSS application examples related to the context under consideration
	2. Align the KSS value proposition to OI manager's preferred self-in-role	• How is value created through OI manager's in-role functions? • To the OI manager, what is distinctive and exciting about the KSS value proposition in consideration? • Does the OI manager acknowledge and fully understand the value of their in-role KSS activities?	• Techniques that can help organise and select facts and ideas (e.g. summarise information about in-role functions, storytelling of experiences related to in-role KSS activities, etc.). • Formal (e.g. context based KSS comprehension tests) and informal (e.g. brainstorming discussions) methods that can check cognitive functioning related to in-role activities and their alignment to value creation through KSS with others
Phase B: *Managing external KSS opportunity related agentic abilities*	3. Assess OI manager's knowledge and ability to extract value from opportunity	• From the OI manager's knowledge and experience perspective, what additional value can be created from KSS? • Which KSS activities are the most critical in ensuring successful attainment of OI goals? • How can the OI manager implement KSS activities for OI without negative influence on existing innovation approaches?	• Techniques that can help analyse (separating the whole into its constituent parts) and synthesis (combine ideas to form new whole) information such as Ishikawa diagrams, iceberg models, thematic visualisation, etc.)
	4. Revise in-role function to	• To the OI manager, what are the most critical KSS	• Techniques that can help enhance self-reflection and self-

	enhance personal agency and extract value from opportunity	challenges related to the opportunity and does the OI manager have the abilities/skills to resolve them? • Which in-role functions should be retained, and which should be adjusted to enhance OI manager's skills and abilities in resolving KSS challenges related to the opportunity? • Is there a balance between OI manager's preferred self-in-role and revised in-role functions?	reaction abilities (e.g. diary notes, retrospect analysis, Think Aloud sessions, etc.) • Mechanisms that can help extend preferred self-in-role perception and in-role KSS abilities (e.g. role rotation, cross-disciplinary secondments, attendance at conferences, etc.)
Phase C: *Modelling external KSS opportunity related agentic cognitive capabilities*	5. Conduct cognitive mapping and scenario workshops	• To the OI manager, what are the most critical KSS parameters, and how do they affect wider OI goals? • Under what conditions does KSS makes sense to the OI manager in attaining desired OI goals?	• Techniques that can help unpack OI manager's cognition on the extent of KSS value and perceptions of attaining desired OI goals based on certain KSS activities – brainstorming, voting/rating, STEP (Social, Technological, Economic, Political) analysis, scenario planning, etc.
	6. Formalise in-role KSS control mechanisms to capture value from opportunity, including conditions on informal self-directed activities	• What monetary or non-monetary control considerations are suitable to reflect desired value creation and capture goals from OI manager's KSS activities? • Is the knowledge ownership and responsibility for KSS clear to the OI manager? • Do the formal and informal in-role functions create desired OI behaviour?	

Phase A: Assessing KSS Opportunity Cognition

The logic of this phase is to understand what the OI manager understands about present KSS opportunity, what they know about realising value from it and what are their perceptions about the opportunity with reference to their preferred self-in-role. As a senior project manager from a white goods manufacturer expressed, "*So nobody was able to explain, and even the technical people, they started to say - Well, you know, there is an algorithm with these variables... the product will do this and that. But it was so complicated, and it remained for a lot of time.*" [P12]

Step 1: Conduct Opportunity Cognition Screening

This step involves gathering useful insights into OI managers' cognition related to the opportunity, to understand knowledge of KSS potential. By understanding the extent and depth of knowledge through

structured evaluation, organisations can more easily screen for cognitively aligned KSS opportunities. Organisations must understand OI manager's underlying perceptions of the KSS opportunity's characteristics, what they recognise as value creating and capturing elements, how they perceive other's motivations and needs to engage in KSS for OI, and which strategies can help them get the most value out of KSS activities. Thus, focusing on a thoroughly evaluated managerial cognition towards KSS in OI is an essential first step.

A systematic approach to KSS opportunity screening as understood by the OI manager tasked to bring it to fruition entails both looking outwards to motivations and needs of knowledge partners and inward to OI manager's preferred self-in-role. For instance, OI manager needs to support and encourage participation of knowledge partners, and simultaneously find satisfaction in doing so. As the principal of a European innovation lab explained, "*key activities that I find myself doing, is to provide some topics of interest, perhaps more of what I call a shopping list, give them some insight into where they should be focusing their efforts... well I enjoy it but I guess, maybe my way of background to clarify that comment, I worked for the most part for start-ups*." [P6]

Step 2: Align The KSS Value Proposition to OI Manager's Preferred Self-In-Role

This step involves evaluating what is distinctive and exciting about the KSS opportunity under consideration from perspective of OI managers' preferred self-in-role, and then aligning the value proposition to in-role KSS activities. Organisations should be weary of KSS opportunities that do not align to OI manager's in-role functions; it will be difficult to extract value from such opportunities, both due to role conflicts and lack of learnt knowledge on required KSS activities. Aligning the KSS value proposition with OI managers' in-role functions is thus an important aspect of this step.

As part of the assessment of OI managers' cognition on KSS value proposition, organisations should also compare the perceived value to deviations required from OI managers' in-role functions for realising the full potential of the opportunity. As the head of innovation and technology at a European network explained their frustration, "*I play the role of broker. I put in contact those who I've been working in this field since 2000. The problem is that when we put these actors in contact, we lose the control, [but] the deal fails because of a different problem… one of the problems of sharing knowledge is the fear they have to lose... we could say I'm so different*." [P7]

If the KSS opportunity is misaligned with OI managers' preferred self-in-role, organisations should put the process on hold to revise OI manager's in-role functions, create extra-role capability enhancing exposure opportunities, or stop pursuing it entirely. The output from Phase A should include an analysis of managerial perceptions and knowledge and a cognition validated KSS opportunity, so that the organisation can be certain that the OI manager is cognitively prepared to realise value from KSS for OI.

Phase B: Managing External KSS Opportunity Related Agentic Abilities

OI managers aim to make informed engagement decisions related to additional risks and value enhancing possibilities from external KSS with reference to their self-concept. As an acting chairperson of a cleantech company aptly described, "*it's a hugely risky business but there's so much more freedom to manoeuvre. Engaging people. I think that's no brainer. I can fully relate to that otherwise I wasn't true believer… so I don't mind.*" [P3]

Step 3: Assess OI Managers' Knowledge and Ability to Extract Value From Opportunity

This step involves a structured evaluation of OI managers' knowledge of the new risks and value enhancing possibilities related to KSS opportunity, and their abilities to create and capture value in the new innovation landscape. For the purpose of identifying potential risks and additional value, organisations can engage in discourse and qualitative analysis of critical factors related to KSS opportunity, that can negatively affect existing innovation approaches and those that can help attain wider innovation goals. This approach forms the basis of learning and can be made more efficient by systematically drawing on OI managers' experience related to specifics of engagement in KSS for OI (a list similar to the OI traps). Notions of ability to build trust, experimentation and accepting the diverse perspectives were common in

our findings. Of note, interviewees placed importance on being seen as knowledgeable and able to harness value from KSS in OI. As a director of OI at consumer packaging solutions company described, "*I need to be perceived as the right guy for that to be legitimate enough - all these new ideas and new technologies that are not really mastered before within the organisation. And so, if people do not trust at the very beginning, that I am skilled enough to identify something that could be valuable for the organisation, then my job is a nightmare.*" [P16]. This battle to shape perceptions of self-in-role may provoke volatility in how cognitive efforts are employed to make informed decisions. Ambitious KSS pursuits may be desirable, but for organisations it is thus also essential to assess OI managers' abilities to extract value from opportunity.

Step 4: Revise In-Role Function to Enhance Personal Agency and Extract Value From Opportunity

This critical step allows OI managers' agentic abilities (ability to proactively influence own functioning and external context) to be optimised for value creation and capture from KSS opportunity under consideration. The focus on enhancing capabilities, however, must not limit the scope of personal agency (beliefs of own abilities to attain desired goals) within existing in-role boundaries – that is, a threat to self-concept – since new in-role functions may not seamlessly fit preferred self-in-role. Organisation should use identified knowledge and abilities from previous steps constructively so that OI managers' personal agency can be shaped to manage new KSS opportunity effectively.

The key actions centre on balancing OI managers' preferred self-in-role and agentic abilities required to harness value from KSS opportunity. The specific focus is to revise in-role functions, with consideration for following personal agency enhancing mechanisms: 1) control stimuli (emphasis on recording, retrieval and use of relevant KSS facts, examples and supporting information), 2) extend exposure (e.g. through selective extra-role functions, secondments, role-rotations), and 3) change deliberation approach (e.g. by breaking apart aspects of KSS opportunity and then synthesising value by combining learnt knowledge and available information). Where there are considerable impediments to implementing these options, they need to be stipulated and, if feasible, monitored overtime for their impact on value leak. As many KSS opportunities are aimed at generating specific core knowledge, organisations need to decide how much of the enhanced personal agency from revised in-role functions will be of relevance to current opportunity, and how much shall help extract value in future KSS opportunities. Due to this ambiguity and inherent risks of disrupting OI managers' preferred self-in-role through role revision, organisations should carefully assess whether the benefits of revised in-role functions outweigh risks of not doing so in the pursuit of KSS opportunities. This cost-benefit analysis should not be seen as a financial exercise, rather as an enabling activity for informed decision-making and harnessing of potential value from KSS in OI. The ultimate output of the opportunity-agency management phase includes a thorough assessment of OI manager's agentic capabilities to extract desired value and a personal agency validated KSS opportunity.

Phase C: Modelling External KSS Opportunity Related Agentic Cognitive Capabilities

We found evidence of overwhelming optimism towards OI, stemming from perceptions of what other companies are doing, benefits of combining heterogenous knowledge and relational commitment towards known knowledge partners. All of the interviewees recalled examples of where KSS led to value creation and capture, but only some were able to retrieve situations under which KSS was detrimental and lead to OI failure. This phase is thus critical, as it involves gaining insights on the agency dynamics (self-reflection, self-reaction capabilities) and consequences to managerial cognition from engaging in KSS opportunity, as well as impact on existing innovation enabling mechanisms. As the innovation and research coordinator at a multinational finance company elaborated on the prospect of engaging in KSS for OI, "*the concept and the process is really important, and always I am behind the idea. But sometimes, lots of parties working with the similar concept inside the company - permission is not so easy… you have to put an effort in, must try and try and try.*" [P8]

Step 5: Conduct Cognitive Mapping and Scenario Workshops

The purpose of this step is to improve the understanding of how aspects of KSS opportunity relate to OI manager's ability to self-reflect and control own perceptions and actions, thus assuring the feasibility of

potential value creation and capture. The main aspect of this analysis is identifying which are the critical KSS parameters and how do they affect OI goals, as the OI manager understands it. In closed innovation models, innovation is closely linked to internal knowledge reserves, such that potential of innovation is limited to how accumulated core knowledge is utilised. In an OI model, tangential knowledge from collaboration may develop simultaneously as new core knowledge matures through external KSS activities, extending innovation possibilities beyond the focus of an OI project.

Cognitive mapping involves unpacking OI managers' cognition on the extent of KSS value and perceptions of attaining wider OI goals from such activities. It can help OI managers 'visualise' the KSS landscape (see de Paula et al., 2023). Board member of a sport technology network described going through iterations of acquiring new information from stakeholders, making sense of it and mapping it to emerging concepts and actions in the context of the product being developed, keeping a reflection diary and then using the learning in managing upstream and downstream KSS opportunities. The approach proved crucial in creating and capturing additional value from KSS opportunity - not only were desired project goals exceeded, but it also enabled further opportunities to revolutionise a global market.

A related scenario analysis involves combining OI managers' KSS assumptions into sets that correspond to different value creation and capture scenarios (pessimistic, expected, optimistic) from engaging in the opportunity. If deemed feasible to pursue KSS opportunity, this can then be used by OI manager to stress test own cognitive abilities. Ideally, the OI managers' ability to self-reflect and control own perceptions and actions should be robust enough to recognise and manage these scenarios. If not, the case is made for enhancing personal agency or introducing formal in-role KSS control mechanisms.

Step 6: Formalise In-Role KSS Control Mechanisms to Capture Value from Opportunity, Including Conditions on Informal Self-Directed Activities

The purpose of this final task is to establish formal KSS control mechanisms that defines the scope, breadth and depth of in-role KSS functions. Often institutionalised (Yildiz et al., 2021), the formal control mechanisms are important for managing both perceptions of self-in-role and desired organisational OI objectives. Due to the formalisation of in-role functions, it becomes OI manager's 'reality', and thus defines the base from which preferred self-in-role is derived. Once formalised, value creation and capture from KSS in OI, are to a greater extent, consequential to the OI managers' ability to employ personal agency in in-role functions, irrespective of the perceptions of KSS in OI.

In formalising KSS control mechanisms, organisations may however create perceptions of forced compliance – stimulating cognitive conflict between what the OI manager believes ought to be and what the job requires them to do. This can create frustration, stress, and psychological discomfort. In such cases, potential of KSS is limited to OI managers' abilities to manage cognitive conflicts and psychological discomfort. Organisations thus need to balance formalised mechanisms with informal mechanisms to allow for cognitive consistency, aligning in-role KSS functions with OI manager's self-concept to foster desired OI behaviour. For instance, the innovation and research coordinator at multinational finance company faced cognitive conflicts in aligning in-role KSS functions with own perceptions of how value creation and capture permissions should be operationalised. This led to frustration and trivialising of own abilities in extracting value from KSS opportunities. Thus, the final output of the opportunity-ability modelling phase should include a thorough evaluation and an agentic cognitive capability validated KSS opportunity, culminating to a go/no-go recommendation.

CONCLUSION

In their efforts to create and capture value from OI, organisation may rush to engage in KSS opportunity without comprehensively considering the consequential influence of OI managers' cognition and agentic cognitive capabilities. Our research emphasises the importance of evaluating managerial cognition for KSS opportunities to avoid traps that can severely impede the additional value potential from engaging in OI. We do not claim that failure of OI initiative can be solely attributed to managerial cognition. Rather, our empirically informed premise is that managerial cognition plays a formative role in how key decision-

makers in OI perceive a KSS opportunity. Yet, organisations must ensure that in-role KSS mechanisms leverage OI managers' perceptions and cognition towards KSS, enhance self-reflection and self-reaction capabilities, and maintain a careful balance between OI manager's preferred self-in-role with in-role KSS functions. Our managerial cognition framework can help organisations avoid unnecessary risks in pursuing external KSS opportunities. It supports both individual OI managers and organisations in taking control of engagement in OI. While our framework has been developed based on KSS in OI experienced by our interviewees, organisations can benefit from its use to evaluate managerial cognition in other KSS contexts. We realise that our conceptualisation is limited to that extent that it is based on responses of an only one OI manager per organisation. Thus, it is not our intention to propose that the framework is correct and complete. Instead, we hope our work stimulates research and practice in the area of cognition in OI, with future research implementing our framework in practice to evaluate managerial cognition towards KSS opportunities for OI, both across organisational boundaries and across contexts to find nuances and further enhance our work.

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APPENDIX

A practical example of traps in external knowledge sourcing and sharing for open innovation.

A case from the arts industry illustrates the traps inherent in KSS in OI. A request for interactive and real-time digital artwork labels to replace existing cards came from the museum director (customer) seeking a solution to deal with the growing social preference for digital experience. Established relationship from previous collaborative projects between the head of creative design at the provider firm and the customer, enabled the fast realisation of an OI contract. Outcome-based KSS activities were formalised to attain a digital gallery experience, and success was tied to visitor feedback on smart labels.

KSS activities occurred over scheduled inter-organisational meetings, during scenario planning sessions, during co-development of label designs and display solutions, field-testing of displays and reviewing of early response from visitors. Whilst the head of creative design (key individual) continued to foster informal exchanges with museum directors, the formal KSS activities involved interactions with other individuals – technology developers, art curators, art editor, archivist, museum communications director, artists and assistants. Having the head of creative design take on the role as key individual driving the initial development of KSS activities ensured that the focal design firm avoided *Trap 1: Pushing out an OI initiative without understanding the OI manager's cognition towards KSS value*.

The key individual brought several years of design experience but had limited understanding of the value museum patrons assign to artwork labels. In the rush to accept the opportunity, the provider fell into *Trap 2: Promising additional gains from KSS in OI without understanding OI manager's personal agency towards KSS in OI.* Because the key individual lacked experience with museum offerings and possessed limited knowledge of the requirements museums place on the characteristics of artwork labels, the provider struggled to recognise useful information to create value (e.g. impact of lighting), effectively assimilate this information to create value (e.g. real-time reconfiguration of smart label display to augment changing lighting) and transfer this new knowledge to capture desired value (e.g. expected visitor rating and possible future such projects across other museums and exhibitions). The key individual in this OI initiative had the belief that is there is value in KSS but had limited learnt experience to realise full potential of KSS opportunity.

The strong pull from customer persuaded the provider of the efficacy of the opportunity without fully understanding the key individual's abilities – consequently, the provider fell into *Trap 3: Getting sold on OI opportunity without understanding the OI manager's agentic cognitive capabilities*. Most OI challenges originate from difficulties in recognising useful external knowledge and effectively assimilating it with existing knowledge pools to create and capture value from KSS activities. A related issue is rooted in understanding how the introduction of a KSS opportunity impacts a key individual's existing cognition towards value in OI engagement. Knowledge gleaned from this OI initiative motivated the provider to institute a process to systematically evaluate any new KSS opportunity in OI and map it to the appropriate type of OI approach.