Ambidextrous networking capability for innovation: an empirical validation in knowledge-intensive R&D organizations across India and Japan

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Abstract

Purpose – This study develops a novel mechanism to measure the ambidextrous networking capability of R&D teams pursuing knowledge-intensive innovation under government-funded R&D organizations across India and Japan. In doing so, it investigates the theoretical roots of network ambidexterity, perceives it from a capability perspective and establishes it as an original construct at team levels.

Design/methodology/approach – A five-stage multi-study design was deployed to measure ambidextrous networking capability for innovation which included qualitative interviews and survey-based data collection from India and Japan. Exploratory and confirmatory factor analysis along with replication and model comparison helped in validating the three factorial structures underlying the focal construct.

Findings – This study reveals the three-factorial structure of the ANCI construct with dimensions – dynamic exploration capabilities, integrative exploitation capabilities and synergistic engagement capabilities. These three dimensions help in measuring the innovation-oriented ambidextrous networking capabilities of R&D teams operating within knowledge-intensive organizations in India and Japan.

Originality/value – The conceptualization of ambidextrous networking for innovation as a team-level capability, its contextualization within R&D organizational settings and its validation across India and Japan are the original contributions of this study.

Keywords Ambidextrous, Network, Capability, Innovation, Organizations, Team, Knowledge

Paper type Research paper

1. Introduction

Networking is critical for innovation (Edelbroek *et al.*, 2023). Especially for knowledge-intensive organizations, inter-organizational networking can improve their innovation performance through superior opportunity recognition, value co-creation and appropriation mechanisms (Abdul Basit *et al.*, 2022; van Lieshout *et al.*, 2021). For example, European small and medium enterprises (SMEs) participation in networking events and trade fairs helped them translate their knowledge into innovation and internationalization performance (Adiguzel and Sonmez Cakir, 2022; Troise *et al.*, 2023). Similarly, the Indian digital technology ecosystem recognized the importance of networking for innovation through trust-building initiatives with potential customers, collaborators and investors during networking events (Anning-Dorson, 2019; Kuk *et al.*, 2024). Such collaborations have also helped Japanese renewable energy producers anticipate shifts in consumer preferences and stakeholder-based collaborative innovations (Kariv *et al.*, 2024; Yamashita, 2021). Conversely, failure to leverage knowledge-based networking mechanisms can diminish market returns and business performance (Reypens *et al.*, 2021). Hence, knowledge-based networking for innovation is important for organizational growth and survival.

Ambidexterity can facilitate networking for knowledge-based innovation (Nowacki and Monk, 2020). It can help organizations surmount their network-centric "competency traps" through

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knowledge-based exploration or exploitation of novel resources for innovation (March, 1991). From a networking perspective, ambidextrous exploration and exploitation of knowledge networks can improve innovation performance in terms of knowledge quality, scale and speed (Fain *et al.*, 2018). For example, aerospace engine manufacturers have shortened the product development cycle through knowledge-based exploration of advanced manufacturing techniques and exploiting them through integration into their operational routines (Fain *et al.*, 2018). Alternatively, the inability to leverage knowledge-based ambidexterity can expose an organization's structural voids and incompetencies to deliver on stakeholder expectations. During the COVID-19 pandemic, collaboration between diagnostic manufacturers, vaccine developers and healthcare practitioners through blockchain technologies helped save several victims through timely detection and diagnosis (Gupta *et al.*, 2023). Although paradoxical tensions between knowledge exploration and exploitation mechanisms exist, they underscore its importance for innovation.

As networking ambidexterity is increasingly gaining importance for exploring new knowledge bases and exploiting them for innovation, it becomes important for organizations to routinize these critical activities. Routinization of innovation-critical tasks helps in optimizing and improvising them according to the operating environments (Wilhelm *et al.*, 2022). Especially in R&D organizations, where multiple teams are responsible for innovation designing, development and testing, an ambidextrous approach towards innovation can improve its operational efficiency and effectiveness (Yang *et al.*, 2015). Hence, an increasing number of knowledge-based organizations are employing a capability-based approach to harnessing organizational networks and leveraging their knowledge to develop superior innovations (Cabeza-Pullés *et al.*, 2020). Such a capability-based approach to ambidextrous networking for innovation can empower R&D organizations to develop superior innovations with optimal resources and deliver maximal results while operating within resource-constrained environments (Nowacki and Monk, 2020).

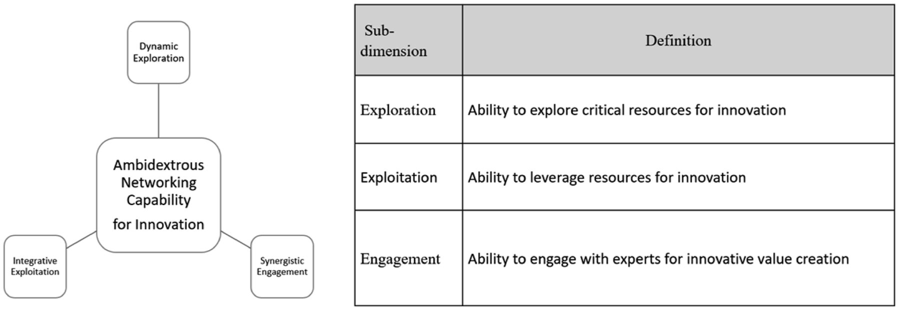
However, extant literature fails to perceive ambidextrous networking for innovation as a strategic capability that, when consistently developed over a period, can provide a sustainable competitive advantage for knowledge-intensive organizations (van Lieshout *et al.*, 2021). This perceptual gap creates a "blindspot" within the extant literature on dynamic capabilities, organizational networking and ambidexterity for innovation scholars who wish to study their impact on innovation performance (Fain *et al.*, 2018; Wei, Yi, *et al.*, 2014). Furthermore, such perceptual "blindspots" in the literature escalate into knowledge voids that can hinder future researchers and practitioners from quantitatively measuring such capabilities within empirical settings. Lastly, this absence of measurement mechanisms further inhibits the process of detailed diagnosis, detection of anomalies and development of interventional plans (Zhang *et al.*, 2017). To overcome such knowledge gaps, this study seeks to address the following research questions:

RQ1. How can ambidextrous networking for innovation be conceptualized from a capability perspective?

RQ2. How can ambidextrous networking capability be contextualized within R&D organizations?

RQ3. How can ambidextrous networking capability for innovation be measured at team levels within cross-cultural settings?

This article aims to resolve these fundamental questions and provide a solid theoretical underpinning to the original conceptualization of the core construct – ambidextrous networking capability of R&D teams for innovation (ANCI) and develop an empirically robust mechanism to measure it at team levels within knowledge-intensive R&D organizations (Figure 1). Accordingly, we investigate the theoretical underpinnings of organizational ambidexterity and networking capabilities for pursuing team innovation. We draw upon the extant literature on organizational ambidexterity and knowledge-based networking capability to find theoretical evidence which can justify the original conceptualization of ambidextrous networking capability and subsequently validate it through a five-stage multi-study design.



Sub-dimension	Definition
Exploration	Ability to explore critical resources for innovation
Exploitation	Ability to leverage resources for innovation
Engagement	Ability to engage with experts for innovative value creation

Figure 1. Construct conceptualization (**Source:** Author's own work)

The theoretical contributions, practical implications along directions for further research have been elaborately described.

2. Theoretical background

This study draws upon three well-established concepts in the management literature – networking capability, ambidextrous capability and team innovation, to provide a solid theoretical underpinning to the conceptualization, working definition and empirical measurement of ambidextrous networking capability for innovation. Historically, networking capability was defined as an "*ability to leverage inter-organizational relationships to gain a sustainable competitive advantage*" (Agostini and Nosella, 2019). Past scholars have underpinned this organizational-level networking capability in the dynamic capabilities view (DCV) RV of the firm (Mitrega *et al.*, 2012). Analogously, ambidextrous capability refers to the "*ability of organizations to balance their exploration and exploitation routines to gain a sustainable competitive advantage*" (Kortmann, 2015). Extant literature has indicated the application of these routines for developing inter-organizational networks which can be leveraged for mutual value addition. In this regard, the role of social capital in facilitating innovation has been well-established as it enables resource sharing and encourages collaboration and knowledge exchange within networking teams (Cabeza-Pullés *et al.*, 2020). Furthermore, social capital positively influences the absorptive capacity of R&D teams through innovation-oriented knowledge acquisition, assimilation and application for value creation (Okatan, 2012). Lastly, team innovation has been defined as the "*ability of teams to integrate their knowledge, skills, and abilities to develop novel innovations (products, processes, or services) for market commercialization*" (Hülsheger *et al.*, 2009; Tikas, 2023). Previous research has established the importance of networking to improve team innovation performance through complementary skill sets, knowledge sharing and collective problem-solving mechanisms. Hence, we draw on them to provide a solid theoretical support to our construct conceptualization and its empirical validation.

Networking capability empowers an organization to consistently initiate, cultivate or terminate its relationship with external organizations based on prevailing market dynamics and contemporary competitive positioning in the industry (Chen *et al.*, 2021; Jarrahi and Sawyer, 2019). Past researchers have defined network competence as a bivariate construct with two components – networking-oriented task execution and qualification of the people in charge of managing the focal organization's relationships. Many scholars built upon this conceptualization and defined networking capabilities as abilities to initiate, develop and leverage inter-organizational relationships through knowledge exchange, coordination, communication and relationship-building (Mitrega *et al.*, 2012). However, past scholars were unable to comprehensively capture the complex nature of these relationships in a dynamic environment marked by high degrees of technological disruptions and market uncertainty (Taheri and van Geenhuizen, 2019). Additionally, extant literature presents a fragmented picture of how networking capabilities evolve, survive and terminate under dynamic environments (Zhang *et al.*, 2017). Lastly, prior research fails to present a comprehensive framework for conceptualizing dynamic networking capabilities for value creation (Roche *et al.*, 2018). Hence, networking capabilities deserve to be studied under dynamic environments by investigating how organizations can build dynamic capabilities for leveraging inter-organizational relationships for mutual value-addition.

The DCV draws from the resource-based view (RBV) which posits that for internal resources to be perceived as potential sources of differential advantage, *"they need to be rare, valuable, non-imitable, and non-substitutable"* (Andersén, 2021; Teece, 2017). Accordingly, organizations should invest in developing resources that contribute to their uniqueness and distinctiveness. However, RBV predominantly highlights the importance of internal resources and does not sufficiently elaborate upon the role of internal capabilities which can help organizations to sustain their long-term competitive advantage (Schoemaker *et al.*, 2018). Especially in high-velocity environments where the pace of technological change is high along with higher levels of "*volatility, uncertainty, complexity, and ambiguity*", organizations need to constantly reconfigure their competitive positions and redeploy their resources to outperform their competitors (Teece, 2017). However, fundamental issues concerning DCV's ability to explicate those exact processes that organizations can adopt to realign and reconfigure their resource base continue to remain unclear (Tikas, 2023). We acknowledge these divergent perspectives but continue to explore their application in the context of conceptualizing networking capabilities for innovation. The dynamic capabilities enable organizations to routinely reconfigure themselves according to external disruptions and leverage their inter-organizational networks to accomplish this reconfiguration (Töpfer *et al.*, 2017). Hence, organizational competence to dynamically manage their relationships with external stakeholders can influence their sustainable competitive advantage.

The of the firm emphasizes the importance of maintaining mutually beneficial relationships with stakeholders which lay external to the organizational contours and yet, play a decisive role in influencing the competitive advantage of the focal organization (Dyer *et al.*, 2018). It highlights the importance of managing relationships with external stakeholders through the identification of synergies or opportunities for mutual value creation and capture. These synergies can be resource-based, capability-based or market-based along with several aspects associated with sharing knowledge, skills and expertise for mutual benefit (Tikas, 2023). RV advises organizational leaders to perceive this relationship management exercise from a strategic lens and treat it as a strategic capability that can help their organization create a "capability differential" against their competitors (Tikas, 2023). However, extant literature endorses a portfolio-based approach toward managing relationships across a diversified set of stakeholders which can contribute toward robust business performance and sustainable competitive advantage (Panetti *et al.*, 2019). Although certain scholars have emphasized the importance of investigating negative behaviors, unequal exploitation or unilateral appropriation of business rent, this research is oriented toward exploring the theoretical underpinnings of knowledge-oriented ambidexterity from a RV of the firm (Jarrahi and Sawyer, 2019). In this regard, it becomes interesting to investigate innovation-oriented network ambidexterity from a cross-cultural perspective and compare its underlying structure across resource-constrained ecosystems (like India) and resource-rich ecosystems (like Japan). Although previous scholars have studied innovation performance across these ecosystems from diversified perspectives like cultural values, beliefs and attitudes that shape innovation processes within organizations, network ambidexterity continues to be understudied from integrative frameworks like Hofstede's dimensions or Trompenaars' models (Ashta *et al.*, 2020). Hence, it is interesting to analyze ambidextrous networking from cross-cultural approaches to hierarchy, collectivism, risk tolerance and adaptability prevalent within the Indian (heterogenous) and Japanese (homogenous) ecosystems.

Ambidexterity has been previously conceptualized as a bivariate construct with – exploration and exploitation – as its two paradoxical dimensions (March, 1991; O'Reilly and Tushman, 2011). Accordingly, exploration has been described as the ability of the organization to engage in search, discovery or experimentation-related activities whereas exploitation refers to an ability to engage in variance-reducing activities efficiently and effectively (Wilden *et al.*, 2018). Thus, "*the ability of an organization to simultaneously pursue exploration and exploitation*" has been widely referred to as organizational ambidexterity (Mom *et al.*, 2019). Accordingly, paradoxical tensions arise during resource allocation in projects that ensure short-term results or long-term survival (O'Reilly and Tushman, 2011). Past scholars have provided theoretical underpinning to the conceptualization of organizational ambidexterity through well-established constructs such as organizational learning (Brix, 2019), absorptive capacity (Wei, Yi, *et al.*, 2014) and dynamic capabilities (O'Reilly and Tushman, 2008). Subsequent researchers advanced our understanding of organizational ambidexterity through empirical studies on novel antecedents such as informal networking (Okatan, 2012) and their influence on organizational performance (Wei, Zhao, *et al.*, 2014). Recent studies also tend to highlight the influence of novel organizational factors which have been introduced as mediators or moderators to provide a richer understanding of the ambidexterity phenomenon and its influence on organizational performance (Kortmann, 2015). However, some scholars have also started to investigate the impact of organizational ambidexterity on innovation performance due to its critical significance in hypercompetitive environments.

An ambidextrous approach toward innovation can help teams overcome existing "competency traps" or "core rigidities" plaguing their organizational settings (March, 1991). Prior studies appear to have identified different types of paradoxical tensions which can be resolved through an ambidextrous approach that suggests a balanced orientation toward the exploration and exploitation of new opportunities. One set of scholars seems to have highlighted the internal-external dynamics associated with managing innovation-oriented ambidexterity. They appear to have emphasized the role of external knowledge acquisition through exploration during the innovation development phase (Zhang *et al.*, 2017). However, prior research has equally underscored the importance of optimizing internal exploitation-oriented processes to capitalize on incumbent resources and capabilities to gain a competitive advantage (Chen *et al.*, 2021). Another set of scholars appears to have perceived these paradoxes from a differentiation-integration perspective (Carmeli and Halevi, 2009). The differentiation perspective advocates the bifurcation of organizational processes based on their explorative or exploitative orientation whereas the integrative perspective advocates their seamless amalgamation for innovation (Zhang *et al.*, 2017). However, several teams take a collective approach toward exploring and exploiting opportunities to innovate but extant literature barely discusses them. Hence, innovation-oriented ambidexterity deserves to be further investigated at team levels to gain a deeper understanding.

Innovation within organizational settings is increasingly being perceived as a team-level phenomenon (Tikas, 2023). Leading organizations tend to routinely capitalize upon their team-based approach toward innovation to consistently differentiate themselves against their competitors and gain a sustainable competitive advantage over them (Chen *et al.*, 2021). Past scholars appear to have extensively studied such team innovation approaches and identified several influential factors such as team communication, team conflict-cohesion and team commitment toward innovation. Past investigations of team-level dynamics have highlighted the importance of psychological safety, team diversity and team leadership in the innovation productivity of R&D teams (Andersén and Ljungkvist, 2021). Another set of scholars studied the impact of team-level aspects such as team composition, team longevity and team size on innovation performance (Hülsheger *et al.*, 2009). We know little about the underlying mechanisms that influence the team innovation dynamics across resource-rich ecosystems (Japan) viz-a-viz resource-constrained ecosystems (India). The extant literature barely explains how organizations operating across such resource-contrasting ecosystems develop superior innovations with minimal resources and deliver maximal results (Tikas, 2023). Hence, it becomes important to investigate networking factors that enable R&D teams to explore and exploit resources for innovation within resource-constrained as well as resource-rich ecosystems.

However, the extant literature does not pay sufficient attention to team-level dynamics that influence networking for innovation due to the predominant focus on firm-level dynamics

(Okatan, 2012). With the increasing number of organizations employing a team-based approach to innovation, it becomes imperative to investigate how R&D teams explore knowledge domains and exploit them for innovation within knowledge-intensive R&D organizations (Porath *et al.*, 2015). Especially in dynamic environments where the rate of technological change is high, we hardly understand how R&D teams can consistently balance their exploration and exploitation initiatives (Chen *et al.*, 2021). We know little about the team-level capabilities that can consistently empower them to identify internal synergies and leverage them through mutually beneficial engagements that enable innovation within dynamic knowledge-intensive settings (Jarrahi and Sawyer, 2019). This lack of prior understanding is manifested through the absence of theoretical constructs, conceptual frameworks and measurement mechanisms to assess network ambidexterity at team levels. Accordingly, this study overcomes the shortcomings in the extant literature by proposing a novel team-level conceptualization, which is grounded in previously well-established theories of DCV, organizational ambidexterity (OA) and knowledge-based team innovation (TI). The working definition of ambidextrous networking capability for innovation (ANCI) has been proposed as “an ability of R&D teams to routinely explore and exploit their networks to improve their innovation performance and sustain their competitive advantage through long-term synergistic engagements”. This enables its measurement and empirical validation within organizational settings.

3. Methodology and results

Multiple rigorous studies were conducted to systematically prepare and empirically validate the ANCI scale as suggested by well-established experts on psychometric scale development (Hinkin *et al.*, 1997). Such a multi-study rigorous approach toward psychometric scale development improves its robustness and generalizability across multiple organizational settings (Churchill, 1979). We draw upon several well-established and highly-cited psychometric scales on innovation capability (Hogan *et al.*, 2011) and absorptive capacity (Flatten *et al.*, 2011) to develop our original ANCI scale (Figure 3). Accordingly, we conducted our first study on “item generation” to develop a large pool of relevant items that could help us measure the ANCI construct from extant literature and expert interviews. The second study involved item rationalization by experts from India and Japan. The third study helped in item reduction and regrouping through exploratory factor analysis (EFA) of the pilot-survey data ($n = 102$) collected from R&D teams operating in government-funded industrial R&D organizations in India.

This study also revealed the three-dimensional nature of the ANCI, as a construct. The next study (study 4) helped confirm this three-dimensional factor structure through confirmatory factor analysis (CFA) conducted on a large sample size ($n = 264$) from approximately 52 R&D teams operating in approximately ten large-sized government-funded R&D-driven organizations across India. The last study involved the collection of additional data from a large sample size ($n = 212$) of respondents from government-funded R&D organizations in Japan which helped in cross-validation. Government-funded R&D organizations were purposely selected for this study as they are mandated to explore new (scientific) knowledge domains and exploit them for societal benefit. Furthermore, they are also mandated to follow transparency, fairness, accountability and responsibility in their research which facilitates data collection from these organizations. This openness to disclose information about their research projects and scientific accomplishments makes them attractive targets for data collection viz-a-viz private-funded R&D labs which maintain strict confidentiality and are bound by non-disclosure agreements. Additionally, due to lack of time, trained volunteers and financial resources, this study was restricted to government-funded R&D organizations and could not include private labs, start-ups or SMEs. Thus, the inclusion-exclusion criterion was framed by judicious use of government mandates, resource constraints and pragmatic limitations of private R&D labs.

3.1 Item generation (study 1)

In-depth interviews with domain experts coupled with an extensive review of extant literature enabled us to gather a substantial pool of items that could help us in measuring our core ANCI construct. Drawing upon the extant discussions and past research, we were able to identify several key dimensions such as ambidexterity, networking capability or innovation capability and trace their evolution over the years. This tracing helped us understand their evolution, significance and applicability across a wide range of organizational settings. A review of the literature also helped us understand multilevel aspects associated with developing ambidexterity for managing innovation-oriented networking within organizational settings. However, there were several aspects associated with managing ambidexterity and networking for innovation that demanded further investigation such as – *(1) Why does ambidextrous networking capability for innovation deserve to be studied in greater detail? (2) How can ambidextrous networking capability for innovation be defined more precisely? (3) Which dimensions of ambidextrous networking capability are critical for its measurement in organizations?* Accordingly, a total of ten experts from India and Japan were invited to participate in this study and requested to provide their unbiased perspectives on the questions present in the interview guide. The selection criterion for experts included parameters like academic accomplishments, practical experience and professional expertise. Each expert had to have a minimum of ten years of post-doctoral experience, several high-quality patents, high-impact articles and a vast experience of managing multiple R&D projects. Key insights from experts helped in identifying relevant items for questionnaire development.

Three underlying themes appeared to emerge from the thematic analysis performed on the transcripts extracted from the expert interviews. These three themes largely revolved around major aspects associated with exploration capabilities, exploitation capabilities and engagement capabilities of industrial R&D teams while pursuing innovation within their organizational settings (Table 1). Expert opinions, as well as anecdotal insights, seem to support these three major aspects of a larger team-level capability that can help R&D teams improve their innovation performance (Table 2). The first theme largely focused on the ability of R&D teams to explore critical resources such as domain experts, networking platforms and knowledge domains that can improve their innovation performance. The second theme largely hinted at the ability of R&D teams to exploit their critical resources to improve their innovation performance (Chen *et al.*, 2021). The third theme majorly pointed toward the R&D team's ability to build long-term relationships with their prospective partner teams for mutual value-addition and knowledge-sharing for innovation (Panetti *et al.*, 2019). Individually, all three aspects tend to reflect an important dimension of a larger construct which can help knowledge-oriented R&D teams to improve their networking with their partners for better innovation performance. These empirical insights resonated with theoretical perspectives from the extant literature to provide a robust grounding to the core construct. Furthermore, they helped in creating an exhaustive pool of 24 items that could be included in a questionnaire. These empirical insights resonated with theoretical perspectives from the extant literature to provide a robust grounding to the core construct and create an exhaustive pool of 24 items for the subsequent study.

3.2 Item purification (study 2)

The twenty-four-item questionnaire was evaluated by a panel of experts, out of which five had industry experience of more than ten years of managing innovation whereas the other five were seasoned academicians of having more than ten years of academic innovation management. The panel examined every item from the questionnaire on a Likert scale to assess its ability to represent the focal construct. They also examined for consistency, comprehensibility and conciseness of the items in the questionnaire so that the actual respondents do not have to struggle with understanding the intended meaning. The panel was also requested to identify

Table 1. Theoretical evidences

Dimension	Brief definition	Sub-dimension	Items	Study	Source
Dynamic Exploration	Ability to explore critical resources for innovation	Experts	My team continuously explores experts for innovation	Empirical/ Conceptual	Andriopoulos and Lewis (2009)
		Platforms	My team consistently explores platforms to demonstrate their innovation	Conceptual	Teece (2017)
		Domains	My team relentlessly explores novel domains for pursuing future innovation	Conceptual	Ardito *et al.* (2018)
Integrative Exploitation	Ability to leverage resources for innovation	Acquisition	My team encourages the quick acquisition of critical resources for innovation	Empirical/ Conceptual	Reypens *et al.* (2021), Linder and Sperber (2019)
		Mobilization	My team enables the quick mobilization of critical resources for innovation	Empirical/ Conceptual	Reypens *et al.* (2021)
		Exploitation	My team facilitates regular utilization of resources for innovation	Empirical/ Conceptual	Chen *et al.* (2021)
Synergistic Engagement	Ability to engage with experts for innovative value creation	Expert Engagement	My team proactively engages with experts to develop complimentary skill-sets	Conceptual	Panetti *et al.* (2019)
		Relationship Development	My team builds good relationships with experts for long-term mutual value addition	Conceptual	

Source(s): Author's own work

any double-barreled items which might confuse the respondents. The panel also suggested the removal of those items which were too lengthy or ambiguous in their structuring to avoid any misinterpretation (Churchill, 1979). Overall, the panel recommended the elimination of five items on counts of their ability to confuse or confound the respondents. Subsequently, the nineteen-item questionnaire was pre-tested with a small sample of twenty industrial R&D team members from government-funded R&D organizations to seek their suggestions for quality improvement and check for the relevance of all the items to practitioner's settings. Based on their feedback, four additional items were removed from the questionnaire on account of their irrelevance to practitioner settings. Collectively, a total of nine items were eliminated to come up with an optimized fifteen-item questionnaire for deployment.

3.3 Item reduction (study 3)

The optimized fifteen-item questionnaire was deployed to collect responses from industrial R&D teams operating across the top ten large-sized technology-driven organizations funded by the government in India. A total of thirty such R&D teams operating across these ten government-funded organizations were able to participate in the initial round of data

Table 2. Latent dimensions

Dimensions	Interviews excerpts
Exploration	Space research and development continue to evolve and break boundaries across different knowledge domains. Our scientists continue to diverge and converge on points that have the potential to generate novel possibilities through meaningful collaborations and mutual value-addition. The road ahead will depend on how we can collectively pursue the grand challenges that lay ahead! [Industrial RandD team leader, Aerospace Labs, India] It is important for us to consistently demonstrate our current as well as future capabilities on various forums so that we establish ourselves as a dominant player in our industry. It also helps us in soliciting feedback, comments and suggestions for improvement from various stakeholders such as prospective customers, collaborators, and competitors. This feedback is really important for our team! [Industrial R&D team leader, Defense Technology Labs, India] Our research demands constant exploration of new phenomena and novel experimentation techniques. Hence, my team actively explores such novel developments and experts who pursue such scientific problems. It helps us in updating ourselves with the latest path-breaking developments and opens up opportunities for future collaborations. [Industrial R&D team leader, Nanotechnology Labs, India]
Exploitation	Imaging instruments play a critical role in our research as they help us in better visualization. However, the acquisition of such instruments is very difficult, cumbersome and expensive. Hence, we need to expedite the acquisition process! [Industrial R&D team leader, Life-science Labs, Japan] Advanced machinery helps us in getting better results as they eliminate the intrusion of undesired impurities. However, such machinery also demands expertise in operating it efficiently and effectively. Hence, we constantly require skilled experts who can operate such advanced equipment and also train novices for future skill-building. [Industrial R&D team leader, Advanced Chemical Sciences Labs, Japan] We possess some of the most advanced equipment for circuit designing and testing. However, our younger scientists tend to be slightly scared of utilizing them due to pre-conceived inhibitions. Hence, we are trying our best to help them navigate through their initial days by routinizing their usage of this advanced equipment so that their internal inhibitions can be eliminated. [Industrial R&D team leader, Advanced Electronics Engineering Labs, India]
Engagement	Healthcare innovations demand collaborations across various domains to solve critical challenges involved in the tedious process of translating solutions from labs to the market. Such challenges demand a collaborative effort across experts from several domains who can come together and build complementary skill sets for developing efficient as well as effective solutions. [Industrial R&D team leader, Healthcare Technology Labs, India] The path toward developing highly efficient renewable energy systems will be long, hard and turbulent. We need to garner every single expert who can add value to our quest toward developing such solutions. Our success will be dependent on our ability to build good relationships with such experts, irrespective of their domains, for long-term mutual value-addition and to ensure energy sufficiency, security and sustainability for everyone on the planet. [Industrial R&D team leader, Renewable Energy Labs, Japan]

Source(s): Author's own work

collection. Four team members from each of these thirty teams were able to provide their responses ($n = 120$) on a five-point Likert scale on several aspects related to ambidextrous networking capability for innovation. These responses ($n = 120$) were thoroughly checked for missing values, non-linearity, outliers or multivariate normality through the statistical software package SPSS (Version 21). Furthermore, EFA was performed over the sample to evaluate its appropriateness through indicators such as KMO (0.87) and adequateness through (significance value, 0.00) Bartlett's test of sphericity. Based on high cross-loadings, commonality scores and low factor loadings (<0.4) decisions regarding item retention (removal) were taken. Eventually, all the 15 items aligned themselves into three groups based on their factor scores, each with an Eigenvalue greater than one. Furthermore, out of these 15 items, seven items could be removed due to cross-loadings or low factor loadings (below 0.4) and the remaining ones collectively explain 60.55% of the total variance.

The principal factor was composed of three items that unambiguously hinted toward representing the R&D team's capability to dynamically explore resources and avenues for future innovations. This principle factor single-handedly contributed to explaining 41.21% of the total variance (Table 3). Furthermore, only three out of five items could significantly contribute toward the composition of this factor whereas two items could not do it due to relatively low factor loadings (<0.4). The first item reflected the ability of the R&D team to continuously explore domain experts to harness their expertise while innovating whereas the second item reflected their ability to explore novel platforms which they can leverage for demonstrating their innovations. Additionally, the third item reflected their ability to relentlessly explore knowledge domains that can open up novel opportunities for them to pursue future innovations within their domains.

The second factor was initially composed of five items that appeared to reflect aspects related to the ability of industrial R&D teams to exploit critical resources for integrating new capabilities into the existing ones for innovation. It can be understood from Table 3 that the second factor was able to explain 10.36% of the total variance through its three significant items. The first item reflected an R&D team's capability to quickly acquire those resources which are critical for innovation. Similarly, the second item reflected their capability to swiftly mobilize critical resources to the target location whereas the third item reflected their ability to rapidly utilize those resources for innovation. The third factor reflected their capability to engage with domain experts to build complementary skill sets and build long-term relationships for mutual value addition. Accordingly, the third factor was named synergistic engagement capabilities which explain 8.98% of the total variance and consist of two items.

3.4 Confirmatory factor analysis (study 4)

CFA on the focal scale validated the three-dimensional factor structure that emerged from the EFA. Accordingly, the data were collected through a questionnaire that was circulated among the top 10 R&D-driven organizations in India which were funded by the government as well as

Table 3. Exploratory factor analysis ($N = 112$: India)

Scale items		Factor loadings
Factor 1		
ANC_03	My team continuously explores experts for pursuing innovations	0.92
ANC_05	My team consistently explores platforms to demonstrate their innovations	0.73
ANC_01	My team relentlessly explores novel domains for pursuing future innovations	0.72
ANC_02	*My team periodically explores the latest software which can be used for innovation*	*
ANC_04	*My team regularly explores for latest hardware that can be used for innovation*	*
Factor 2		
ANC_07	My team encourages the quick acquisition of critical resources for innovation	0.93
ANC_09	My team enables the quick mobilization of critical resources for innovation	0.82
ANC_06	My team facilitates regular utilization of resources for innovation	0.71
ANC_08	*My team rationalizes sharing of critical resources with external experts*	*
ANC_10	*My team protects access to critical resources with external experts*	*
Factor 3		
ANC_12	My team proactively engages with experts to develop complementary skill-sets	0.83
ANC_14	My team builds good relationships with experts for long-term mutual value-addition	0.72
ANC_11	*My team regularly seeks to advise from external experts about innovation*	*
ANC_15	*My team encourages critical feedback from external experts while innovating*	*
ANC_13	*My team critically analyses failures during innovation with external experts*	*

Note(s): * indicates items that were eliminated iteratively
Source(s): Author's own work

mandated to pursue cutting-edge innovations. Accordingly, the data were collected through a questionnaire that was circulated among the top ten government-funded R&D-driven organizations mandated to pursue cutting-edge innovations. A total of 264 team members belonging to 66 industrial R&D teams operating in Indian organizations responded to the questionnaire which consisted of nine items checking for ANCI. All these respondents were requested to mark their responses on a five-point Likert scale, for each of the nine items in the ANCI questionnaire. Subsequently, CFA was employed iteratively to validate the three-factorial structure of the core construct and evaluate the scale's goodness of fit (Bentler and Hu, 1998). Key indices such as the Goodness-of-fit index (GFI, 0.98), comparative fit index (CFI, 0.98) and Tucker–Lewis index (TLI, 0.97), pointed toward an acceptable fit (Bentler and Hu, 1998). Furthermore, major indices such as the normed chi-square statistic (χ^2/df, 1.28), the standardized root mean residual (SRMR, 0.03) and the root mean square error of approximation (RMSEA, 0.033) were also found to be acceptable (Bentler and Hu, 1998). To counter common-method bias (CMB), items were kept simple by avoiding double-barreled statements, complex jargon and misleading questions (Churchill, 1979; Podsakoff *et al.*, 2012). Furthermore, Harman's single-factor test did not show any of the eight factors explaining more than 50% of the total variance (collectively or individually). Of the eight factors, only three had eigenvalues greater than one and the principal factor could individually explain 42.07% (less than 50%) of the total variance (Podsakoff and Organ, 1986). Hence, the common method bias was not a problem for this sample. To gain additional validation, the marker variable technique was used to check CMB by correlating a theoretically unrelated construct with the focal construct to find no significant differences in the factor loadings that can be attributed to the addition of the marker variable (Viswanathan and Kayande, 2012). Thus, CMB was comprehensively avoided using recommended ex-ante and ex-post techniques.

3.5 Reliability and validity

Composite reliability (CR) of the ANCI scale was established through assessment of the CR scores for the three components emerging from the CFA performed on a large sample ($n = 264$ respondents) from India – dynamic exploration capability (CR, 0.79), integrative exploitation capability (CR, 0.78) and synergistic engagement capability (CR, 0.82). It can be observed from Table 4 that the CR scores for these three components are above the recommended threshold (CR > 0.7) indicating satisfactory levels of CR (Cronbach, 1951; Bentler and Hu, 1998). Furthermore, the convergent validity of the ANCI scale was established through an assessment of the significance level ($p < 0.05$) for all the constituent items belonging to their respective dimensions. Additionally, the discriminant validity was established through the Fornell and Larcker (1981) criterion which posited that the average variance extracted (AVE) scores should be greater than the square of inter-factor paired correlations. As depicted in Table 4, the AVE scores for all three components of ANCI – dynamic exploration, integrative exploitation and synergistic engagement – satisfy the Fornell and Larcker (1981) criterion which helps in establishing the discriminant validity.

3.6 Replication and validation (study 5)

In addition to the test data sample from India, further data on the same questionnaire was collected from different R&D teams in Japan. Although, the inclusion-exclusion criterion remained unchanged, a completely different set of respondents from Japan participated in this study. Furthermore, it was ensured that both these studies had a sufficient time lag of at least one month between them to avoid potential biases which might affect the responses to the questionnaire. This was accomplished by initiating the second study after a month after the closure of the first study. Collectively, a sufficiently large sample of respondents ($n = 212$) from Japanese R&D organizations was collected to form a replication sample. The findings in Table 4, depict that the key indices such as the Tucker–Lewis index (TLI, 00.97), the goodness-of-the-fit index (GFI, 00.97) and the comparative fit index (CFI, 00.98) are well within the

Table 4. Ambidextrous Networking Capability of R&D teams

Factor composition		Test sample (N = 264: India)			Validation sample (N = 212: Japan)		
		Reliability	AVE	Factor loadings	Reliability	AVE	Factor loadings
Dynamic exploration capability (DXC)		0.79	0.55		0.85	0.65	
ANC_03	My team continuously explores experts for pursuing innovations			0.87			0.94
ANC_05	My team consistently explores platforms to demonstrate their innovations			0.75			0.86
ANC_01	My team relentlessly explores novel domains for pursuing future innovations			0.62			0.62
Integrative exploitation capability (IXC)		0.78	0.57		0.79	0.56	
ANC_07	My team encourages the quick acquisition of critical resources for innovation			0.75			0.92
ANC_09	My team enables quick mobilization of critical resources for innovation			0.74			0.71
ANC_06	My Team facilitates regular utilization of resources for innovation			0.72			0.61
Synergistic engagement capability (SEC)		0.82	0.71		0.73	0.57	
ANC_12	My Team proactively engages with experts to develop complementary skill-sets			0.93			0.76
ANC_14	My Team builds good relationships with experts for long-term mutual value-addition			0.71			0.74

Goodness-of-the-fit indices	χ^2	DF	Normed χ^2	TLI	GFI	CFI	SRMR	RMSEA
Test sample	21.88	17	1.28	0.97	0.98	0.98	0.03	0.033
Validation sample	23.26	17	1.36	0.97	0.97	0.98	0.03	0.042

Note(s): All the factor loadings were significant ($p < 0.05$). AVE = average variance extracted; df = 41 for both samples; χ^2 = chi-square; Normalized $\chi^2 = \chi^2$/df; TLI = Tucker–Lewis index; GFI = Goodness of Fit index; CFI = comparative fit index; SRMR = standardized root mean residual; factor loadings reported were completely standardized parameter estimates
Source(s): Author's own work

recommended levels as suggested by the experts (Bentler and Hu, 1998). Furthermore, it was also observed that the standardized root mean residual (SRMR, 0.03), the root means square error of approximation (RMSEA, 0.042) and the normalized chi-square statistic (χ^2/df, 1.36) were observed to be under the recommended ranges (Bentler and Hu, 1998). The CR scores were found to be within the acceptable thresholds for all the individual components of the core construct (ANCI) namely – dynamic exploration (CR, 0.85), integrative exploitation (CR, 0.79) and synergistic engagement (CR, 0.73) (Kline, 2013; Ryu and West, 2009). Factor loadings for each of these components were found to be significant at the 0.001 level and typically ranged above the suggested level of 0.7 for all the constituent items indicating satisfactory levels of convergent validity. Furthermore, the AVE scores were above the satisfactory level of 0.5 with high values of factor loadings and low values of cross-loadings indicating satisfactory levels of convergent validity. Additionally, AVE scores help in establishing the discriminant validity as per the Fornell and Larcker (1981) criterion.

3.7 Nomological validity

The nomological validity of the ANCI scale was established by assessing the scale's ability to behave with those constructs which have been theoretically well-established in the extant literature on innovation management (Andersén and Ljungkvist, 2021). Accordingly, we chose "team innovation performance" as a construct that could be employed for assessing the nomological validity of our core construct (Figure 2). The integral components of the ANCI construct were dynamic exploration capabilities, integrative exploitation capabilities and synergistic engagement capabilities whereas aspects associated with team innovation performance were innovation effectiveness and innovation efficiency (Xie *et al.*, 2020a). Subsequently, correlations between the integral components of the core construct and team innovation performance were computed (see Table 5). It can be inferred from there that correlations between team innovation performance and the components of the ANCI construct are significantly strong and positive in the test sample ($n = 264$) from India and the validation sample from Japan ($n = 212$). Thus, ambidextrous networking capabilities positively influence team innovation performance as they enable dynamic exploration, integrative exploitation and synergistic engagement within knowledge-intensive R&D teams. These findings align well with previous studies on teams operating in dynamic environments that leverage agreement-seeking behaviors that facilitate knowledge integration during innovation-oriented exploration and exploitation (van Lieshout *et al.*, 2021). This establishes the nomological validity of the ANCI construct.

3.8 Competing models

Multiple models measuring ANCI were created and contested against each other to explore the best-fitting model. Collectively four different models were compared against each other, namely – the three-factor correlated model, the three-factor uncorrelated model, the single-factor model and the null model. Chi-square difference tests were conducted on the test sample ($n = 264$ respondents) from India and the validation sample ($n = 212$ respondents) from Japan to find out the best-fitting model (Hair *et al.*, 2020; Li and

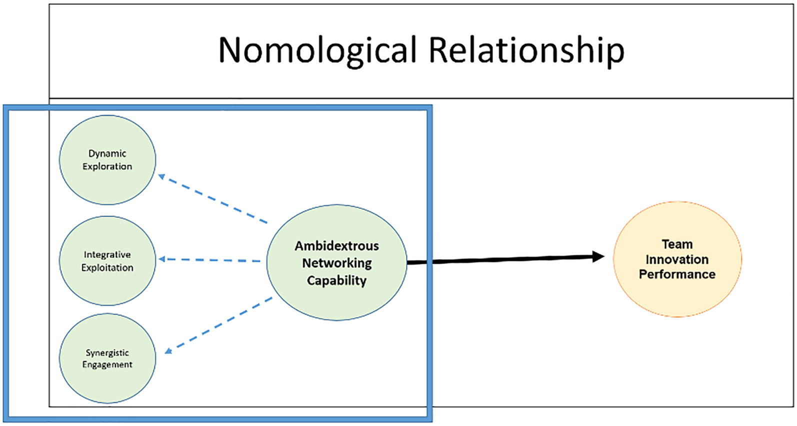


Figure 2. Nomological relationship (**Source:** Author's own work)

Figure 3. Multi-method research design (**Source:** Author's own work)

Beretvas, 2013). Analysis of the Chi-square statistic ($\Delta\chi^2$) and other key parameters pointed out that the three-factor correlated model is the best-fitting model as depicted in Table 6. Additional support for this finding could be garnered from analyzing both samples which indicate that the three-factor correlated model is the best-fitting model to measure ANCI in public industrial R&D organizations.

4. Discussion

Theoretical contributions are aligned toward establishing the core construct of ANCI and developing an empirical mechanism to measure it at team levels within organizational settings.

Table 5. Nomological validity

	DXC	IXC	SEC
Test sample (*N* = 264: India)			
Dynamic exploration capability (DXC)	0.55^{***}		
Integrative exploitation capability (IXC)			
Synergistic engagement capability (SEC)	0.44***	0.54^{***}	0.45
Team innovation performance (TIP)	0.05	0.06	
Validation sample (*N* = 212: Japan)			
Dynamic exploration capability (DXC)	0.56^{***}		
Integrative exploitation capability (IXC)			
Synergistic Engagement capability (SEC)	0.43^{***}	0.486^{***}	0.437^{***}
Team innovation performance (TIP)	0.11	0.60^{***}	

Note(s): $^{***}p < 0.001$
Source(s): Author's own work

Table 6. Factorial model comparisons

Model	χ^2	df	$\Delta\chi^2$	Δdf	Normalized χ^2	TLI	GFI	CFI	SRMR
Test sample (*N* = 264:India)									
Null	787.35	28	–	–	28.12	0.00	0.00	0.31	0.45
One-factor	281.62	20	505.73*	8	14.08	0.52	0.77	0.65	0.12
Three-factor uncorrelated	69.74	18	211.88*	2	3.87	0.89	0.94	0.93	0.15
Three-factor correlated	21.88	17	47.86*	1	1.28	0.97	0.98	0.98	0.03
Validation sample (*N* = 212: Japan)									
Null	768.84	28	–	–	27.44	0.00	0.00	0.43	0.35
One-factor	247.20	20	521.64*	8	12.364	0.53	0.74	0.66	0.14
Three-factor uncorrelated	67.94	18	179.26*	2	3.77	0.88	0.93	0.92	0.17
Three-factor correlated	23.26	17	44.68*	1	1.36	0.97	0.97	0.98	0.03

Note(s): χ^2 = chi-square; df = degrees of freedom; $\Delta\chi^2$ = difference in chi-square statistic; Δdf = difference in degrees of freedom; Normalized $\chi^2 = \chi^2$/df; *CFI = comparative fit index; RMR = standardized root mean residual; TLI = Tucker–Lewis index.* $^{*}p < 0.05$
Source(s): Author's own work

Our practical contributions are aligned toward benchmarking knowledge-intensive R&D teams on their ambidextrous networking capability for innovation. This study contributes to the extant literature on knowledge-based networking capability by conceptualizing it from the capability perspective along with blending organizational ambidexterity with team innovation (Hülsheger *et al.*, 2009; Teece, 2017). This conceptualization enables scholars to perceive this team-level capability as a *"critical source of competitive advantage"* and establishes an empirically validated mechanism to measure it within knowledge-intensive R&D organizations. It reveals the three-factorial nature of the ANCI construct with underlying sub-dimensions – dynamic exploration, integrative exploitation and synergistic engagement capabilities. Dynamic exploration capability reflects the capability of R&D teams to dynamically explore their internal and external environments to find domain experts, events and platforms that can be leveraged to improve their innovation. The integrative exploitation capability reflects their ability to consistently integrate new resources and leverage them through quick acquisition, mobilization and utilization. The synergistic engagement capabilities reflect the capability of

R&D teams to proactively engage with partners to build complementary skills and leverage them for innovation. Collectively, the ambidextrous networking capabilities of R&D teams can be reflected through these three dimensions – dynamic exploration, integrative exploitation and synergistic engagement, as elaborated below.

Dynamic exploration capabilities, the first dimension, can help knowledge-based R&D teams improve their innovation performance through routinizing exploration of the latest resources, world-class experts and opportunities to demonstrate their innovations (Andriopoulos and Lewis, 2009). Routinized exploration of knowledge resources enables R&D teams to proactively sense the latest developments in a particular knowledge domain, understanding their practical implications and potential applications for problem-solving. For instance, if a healthcare R&D team is working on developing vaccines for virulent diseases, dynamic exploration capabilities can help such R&D teams in proactively searching for novel discoveries in vaccine development, identifying the best experts who specialize in vaccine formulations and collaborating with manufacturing partners for large-scale commercialization (Gupta *et al.*, 2023). Past research on dynamic capabilities supports such instances where R&D teams leverage their partnerships for sensing novel opportunities across diversified knowledge domains, seizing them through proactive value creation and transforming knowledge into innovations that can be commercialized from labs to markets (Cabeza-Pullés *et al.*, 2020). However, prior research on network ambidexterity fails to perceive it from a dynamic capabilities perspective which undermines its strategic importance during the innovation process. Furthermore, past scholars fail to provide an empirical mechanism for measuring such networking capabilities at team levels within R&D organizations. This study overcomes such past lacunas by providing an item-level composition of dynamic exploration capabilities which gets reflected through three validated items (Ardito *et al.*, 2018). These three items along with their representative sub-dimension (dynamic exploration) extend our collective understanding of ambidextrous networking capabilities that can be leveraged by R&D teams to improve their innovation performance.

Integrative exploitation capabilities, the second dimension, can empower R&D teams to coordinate, combine and consolidate their internal resources and capabilities for profiting from innovation (Linder and Sperber, 2019). Routinizing the exploitation of internal resources and capabilities for value creation can help R&D teams seamlessly integrate the latest features in their existing products or services (Reypens *et al.*, 2021). For instance, integrating artificial intelligence (AI) based decision support systems in aerospace R&D can help speed up innovation performance, improve efficiency and enhance safety during the new engine (product) development process (Troisi *et al.*, 2024). Past research supports this integrative exploitation through empirical evidence like increased usage of sustainable designs, faster production cycles and safer manufacturing operations (Chen *et al.*, 2021). However, prior research fails to perceive integrative exploitation as a constituent dimension of ambidextrous networking capability which can be measured within R&D organizational settings. Moreover, extant research barely provides any measurement mechanism to assess this capability at team levels along with their item-level composition (Tikas, 2023). This study overcomes these limitations in the extant research by theoretically establishing integrative exploitation as an integral dimension of ambidextrous networking capabilities along with its item-level measurement mechanism (Kortmann, 2015). Thus, integrative exploitation capabilities can now be measured at team levels within R&D organizations through three unique item-level indicators (resource acquisition, mobilization and utilization). Collectively, integrative exploitation emerges as the second dimension that reflects the ambidextrous networking capabilities of R&D teams through resource acquisition, mobilization and utilization to improve innovation performance.

Synergistic engagement capabilities, the third dimension, can help knowledge-intensive R&D teams in routinizing their internal processes of identifying synergies with partnering teams and building long-term relationships with them for mutual value-addition. Such synergized engagements can optimize development cycles by enabling R&D teams to rapidly design, develop and deploy novel products in the market (Panetti *et al.*, 2019). For example, advancements in nanotechnology are propelling innovations in the wearable electronics industry through customer-centric health monitoring sensors, smart textiles and interactive interfaces. Past research supports such synergistic engagements of cross-functional R&D teams as they collectively contribute to improving innovation performance, structural flexibility and energy efficiency (Teece, 2017). However, extant literature fails to perceive synergistic engagement as a source of long-term innovation capability that can be measured at team levels within R&D organizations (Hülsheger *et al.*, 2009). Additionally, past scholars barely provide an item-level assessment mechanism to measure such team-level synergistic engagement capabilities (Mitrega *et al.*, 2012). This study overcomes these shortcomings in the extant literature on R&D networking by theoretically establishing synergistic engagement as the third dimension of ambidextrous networking capabilities and validating its item-level measurement mechanism through two indicators – proactive engagement and relationship-building with domain experts. Proactive engagement helps R&D teams in the initial identification of synergies with domain experts whereas the relationship-building orientation helps them leverage those synergies for long-term value addition (Kim and Song, 2021). These novel indicators and underlying dimensions that reflect synergistic engagement help us in extending our understanding of ambidextrous networking.

Generally, R&D teams with high network ambidexterity would tend to display high levels of these sub-dimensions whereas teams struggling with low network ambidexterity would be scoring low on any one or all of the three sub-dimensions. Furthermore, due to the orthogonal nature of these sub-dimensions, a low score on any one of them may not necessarily influence a low score on the remaining ones. Hence, this ANCI framework can also be used as a diagnostic tool within government-funded R&D organizations as it can differentiate R&D teams based on their ambidextrous networking capabilities (Hogan *et al.*, 2011; Mitrega *et al.*, 2012). Cross-validation of the ANCI framework across Indian and Japanese government-funded R&D organizations further establishes its reliability, relevance and validity. Additionally, it also establishes the robustness of the framework across R&D ecosystems, which may be distinct from each other in terms of their innovation culture, economic development and demographic composition. This study extends the scholarly conversation on how ambidextrous network capabilities can be measured at team levels by establishing the robustness of the ANCI framework across a homogenous (Japanese) culture as well as a heterogeneous (Indian) culture (Ashta *et al.*, 2020). This finding adds a new dimension to the ongoing conversations on organizational ambidexterity and dynamic capabilities within innovation networks by highlighting the importance of identifying synergies at team levels and leveraging them for innovation performance. Hence, when it comes to pursuing advanced R&D projects within government-funded organizations, R&D teams in Japan (or India) need to look beyond cultural homogeneity (or heterogeneity) and develop routines that can help them to collectively explore, exploit and engage with domain experts for improving their innovation pace, performance and productivity (Chen *et al.*, 2021). In this regard, findings from this study create the foundation for future cross-cultural research on organizational ambidexterity, dynamic capabilities and team innovation across other homogenous and heterogeneous R&D ecosystems beyond India and Japan.

5. Managerial implications

The practical implications of this study are aligned with providing a theoretically grounded and empirically robust psychometric ANCI scale that can assess the knowledge-based networking capabilities of R&D teams operating in government-funded R&D organizations. Organizational leaders can use this ANCI scale to compare and contrast their R&D teams on three dimensions of ambidextrous networking capabilities. This helps them identify the best-performing teams that set the benchmarks in dynamic exploration, integrative exploitation and synergistic engagement for other teams to follow.

Additionally, R&D managers can use these dimensions to diagnose the non-performing teams by identifying their weaknesses in networking strategies through an eight-item ANCI scale and improvise them through expert intervention. The ANCI construct empowers organizational leaders to perceive network ambidexterity from a capability perspective and develop functional routines that can help their R&D teams to simultaneously explore and exploit their partner networks for innovation. For instance, if robotics R&D teams are finding it difficult to search for highly specialized knowledge-based experts in psychology to collaborate on human-robot interfacing, the first dimension of the ANCI construct (dynamic exploration) can help them find relevant experts, platforms or domains. Analogously, if a life-science R&D team is not able to completely leverage complex equipment or a complicated process for getting their experimental results, the second dimension (integrative exploitation) can help them in seamlessly acquiring, mobilizing and utilizing that equipment (process), to the best of its potential. Lastly, if a healthcare R&D team is struggling to scale up their innovation, the third dimension (synergistic engagement) can help them engage with domain experts and leverage long-term synergies that can enable them to sustain large-scale commercialization of their innovations. Collectively, this study helps practitioners in benchmarking their R&D teams on three dimensions of ambidextrous networking, diagnosing their weaknesses at team levels and suggesting corrective actions through their item-level indicators to overcome those weaknesses.

6. Limitations

This study conceptualizes ambidextrous networking capability for innovation as a team-level capability and develops a measurement mechanism to assess it through dynamic exploration, integrative exploitation and synergistic engagement. However, certain operational complexities involved in collecting cross-sectional data, restricted access to target respondents and methodological challenges in executing multiple studies could have constrained the generalizability of these results. The first among them can be attributed to the nature and scope of the participant organizations, which were predominantly government-funded organizations pursuing cutting-edge research and development (R&D) in the domain of science and technology in India. Future studies can overcome these limitations by including a more diverse set of government-funded as well as private-funded industrial R&D organizations pursuing advanced scientific and technological innovation. Additionally, they can also include organizations that pursue medium-tech or low-tech to improve the richness and robustness of their findings. Furthermore, the scope of the study can also be extended to start-ups and entrepreneurial ventures which tend to rely on their networking capabilities to gain their initial customers and market traction. Future researchers can also include novel cross-cultural aspects by replicating this study across different countries, cultures and contexts to improve our collective understanding of the ambidextrous networking capability for innovation.

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References

Abdul Basit, S., Kuhn, T. and Cantner, U. (2022), “The role of market competition for knowledge competencies, R&D and innovation: an empirical analysis for German firms”, *European Journal of Management Studies*, Vol. 27 No. 2, pp. 229-253, doi: 10.1108/ejms-09-2021-0084.

Adiguzel, Z. and Sonmez Cakir, F. (2022), “Examining the effects of strategic orientation and motivation on performance and innovation in the production sector of automobile spare parts”, *European Journal of Management Studies*, Vol. 27 No. 2, pp. 131-153, doi: 10.1108/ejms-01-2022-0007.

Agostini, L. and Nosella, A. (2019), “Inter-organizational relationships involving SMEs: a bibliographic investigation into the state of the art”, *Long Range Planning*, Vol. 52 No. 1, pp. 1-31, doi: 10.1016/j.lrp.2017.12.003.

Andersén, J. (2021), “A relational natural-resource-based view on product innovation: the influence of green product innovation and green suppliers on differentiation advantage in small manufacturing firms”, *Technovation*, Vol. 104, February, 102254, doi: 10.1016/j.technovation.2021.102254.

Andersén, J. and Ljungkvist, T. (2021), “Resource orchestration for team-based innovation: a case study of the interplay between teams, customers, and top management”, *R&D Management*, Vol. 51 No. 1, pp. 147-160, doi: 10.1111/radm.12442.

Andriopoulos, C. and Lewis, M.W. (2009), “Exploitation-exploration tensions and organizational ambidexterity: managing paradoxes of innovation”, *Organization Science*, Vol. 20 No. 4, pp. 696-717, doi: 10.1287/orsc.1080.0406.

Anning-Dorson, T. (2019), “Complementarity of capabilities across cultures: innovation, customer involvement, and competitiveness of service firms across India and the UK”, *Cross Cultural and Strategic Management*, Vol. 26 No. 4, pp. 567-585, doi: 10.1108/CCSM-12-2018-0217.

Ardito, L., D’Adda, D. and Messeni Petruzzelli, A. (2018), “Mapping innovation dynamics in the Internet of Things domain: evidence from patent analysis”, *Technological Forecasting and Social Change*, Vol. 136, May 2017, pp. 317-330, doi: 10.1016/j.techfore.2017.04.022.

Ashta, A., Stokes, P.J., Smith, S.M. and Hughes, P. (2020), “Japanese CEOs cross-cultural management of customer value orientation in India”, *Management Decision*, Vol. 59 No. 10, pp. 2355-2368, doi: 10.1108/MD-06-2020-0776.

Bentler, P.M. and Hu, L. (1998), “Fit indices in covariance structure modeling: sensitivity to underparameterized model misspecification”, *Psychological Methods*, Vol. 3 No. 4, pp. 424-453, doi: 10.1037/1082-989x.3.4.424.

Brix, J. (2019), “Ambidexterity and organizational learning: revisiting and reconnecting the literatures”, *The Learning Organization*, Vol. 26 No. 4, pp. 337-351, doi: 10.1108/TLO-02-2019-0034.

Cabeza-Pullés, D., Fernández-Pérez, V. and Roldán-Bravo, M.I. (2020), “Internal networking and innovation ambidexterity: the mediating role of knowledge management processes in university research”, *European Management Journal*, Vol. 38 No. 3, pp. 450-461, doi: 10.1016/j.emj.2019.12.008.

Carmeli, A. and Halevi, M.Y. (2009), “How top management team behavioral integration and behavioral complexity enable organizational ambidexterity: the moderating role of contextual ambidexterity”, *The Leadership Quarterly*, Vol. 20 No. 2, pp. 207-218, doi: 10.1016/j.leaqua.2009.01.011.

Chen, J., Di Minin, A., Minshall, T., Su, Y.shan, Xue, L. and Zhou, Y. (2021), “The New Silk Road: R&D networks, knowledge diffusions, and open innovation”, *R&D Management*, Vol. 51 No. 3, pp. 243-246, doi: 10.1111/radm.12479.

Churchill, G.A. (1979), “A paradigm for developing better measures of marketing constructs”, *Journal of Marketing Research*, Vol. 16 No. 1, p. 64, doi: 10.2307/3150876.

Cronbach, L. (1951), “Coefficient alpha and the internal structure of tests”, *Psychometrika*, Vol. 16 No. 3, pp. 297-334, doi: 10.1007/BF02310555.

Dyer, J.H., Singh, H. and Hesterly, W.S. (2018), “The relational view revisited: a dynamic perspective on value creation and value capture”, *Strategic Management Journal*, Vol. 39, November 2015, pp. 3140-3162, doi: 10.1002/smj.2785.

Edelbroek, R., Peters, P. and Blomme, R.J. (2023), "Leading innovation in an inter-organizational team together: the moderating role of shared leadership behavior in the transitioning between different phases of the open innovation process", *European Journal of Management Studies*, Vol. 28 No. 2, pp. 91-114, doi: 10.1108/ejms-12-2021-0113.

Fain, N., Wagner, B. and Kay, N. (2018), "Driving innovation through ambidextrous service provision — long life cycle products in manufacturing contexts", *Technological Forecasting and Social Change*, Vol. 130, May 2016, pp. 3-13, doi: 10.1016/j.techfore.2017.05.013.

Flatten, T.C., Engelen, A., Zahra, S.A. and Brettel, M. (2011), "A measure of absorptive capacity: scale development and validation", *European Management Journal*, Vol. 29 No. 2, pp. 98-116, doi: 10.1016/j.emj.2010.11.002.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, p. 39, doi: 10.2307/3151312.

Gupta, S., Modgil, S., Bhatt, P.C., Chiappetta Jabbour, C.J. and Kamble, S. (2023), "Quantum computing led innovation for achieving a more sustainable Covid-19 healthcare industry", *Technovation*, Vol. 120, April 2022, 102544, doi: 10.1016/j.technovation.2022.102544.

Hair, J.F., Howard, M.C. and Nitzl, C. (2020), "Assessing measurement model quality in PLS-SEM using confirmatory composite analysis", *Journal of Business Research*, Vol. 109, August 2019, pp. 101-110, doi: 10.1016/j.jbusres.2019.11.069.

Hinkin, T.R., Tracey, J.B. and Enz, C.A. (1997), "Scale construction: developing reliable and valid measurement instruments", *Journal of Hospitality and Tourism Research*, Vol. 21 No. 1, pp. 100-120, doi: 10.1177/109634809702100108.

Hogan, S.J., Soutar, G.N., McColl-Kennedy, J.R. and Sweeney, J.C. (2011), "Reconceptualizing professional service firm innovation capability: scale development", *Industrial Marketing Management*, Vol. 40 No. 8, pp. 1264-1273, doi: 10.1016/j.indmarman.2011.10.002.

Hülsheger, U.R., Anderson, N. and Salgado, J.F. (2009), "Team-level predictors of innovation at work: a comprehensive meta-analysis spanning three decades of research", *Journal of Applied Psychology*, Vol. 94 No. 5, pp. 1128-1145, doi: 10.1037/a0015978.

Jarrahi, M.H. and Sawyer, S. (2019), "Networks of innovation: the sociotechnical assemblage of tabletop computing", *Research Policy*, Vol. 1, December 2018, 100001, doi: 10.1016/j.repolx.2018.100001.

Kariv, D., Cisneros, L., Kashy-Rosenbaum, G. and Krueger, N. (2024), "Does generation matter to innovation development? A new look at entrepreneurial businesses from the perspective of resource-based view (RBV)", *European Journal of Innovation Management*, Vol. 27 No. 2, pp. 424-446, doi: 10.1108/EJIM-05-2022-0226.

Kim, J. and Song, C. (2021), "The relationship between R&D team diversity and team creativity", *Management Decision*, Vol. 59 No. 2, pp. 175-189, doi: 10.1108/MD-12-2019-1727.

Kline, R. (2013), "Exploratory and confirmatory factor analysis", in *Applied Quantitative Analysis in Education and the Social Sciences*, Routledge, New York, pp. 171-207.

Kortmann, S. (2015), "The mediating role of strategic orientations on the relationship between ambidexterity-oriented decisions and innovative ambidexterity", *Journal of Product Innovation Management*, Vol. 32 No. 5, pp. 666-684, doi: 10.1111/jpim.12151.

Kuk, G., Schaarschmidt, M. and Homscheid, D. (2024), "All of the same breed? A networking perspective of private-collective innovation", *Journal of Business Research*, Vol. 172, October 2023, 114406, doi: 10.1016/j.jbusres.2023.114406.

Li, X. and Beretvas, S.N. (2013), "Sample size limits for estimating upper level mediation models using multilevel SEM", *Structural Equation Modeling*, Vol. 20 No. 2, pp. 241-264, doi: 10.1080/10705511.2013.769391.

Linder, C. and Sperber, S. (2019), "Towards a deeper understanding of the emergence of process innovations: which role do inter-organisational learning and internal knowledge exploitation play?", *Journal of Engineering and Technology Management – JET-M*, Vol. 53, January, pp. 33-48, doi: 10.1016/j.jengtecman.2019.04.001.

March, J.G. (1991), "Exploration and exploitation in organizational learning", *Organization Science*, Vol. 2 No. 1, pp. 71-87, doi: 10.1287/orsc.2.1.71.

Mitrega, M., Forkmann, S., Ramos, C. and Henneberg, S.C. (2012), "Networking capability in business relationships – concept and scale development", *Industrial Marketing Management*, Vol. 41 No. 5, pp. 739-751, doi: 10.1016/j.indmarman.2012.06.002.

Mom, T.J.M., Chang, Y.Y., Cholakova, M. and Jansen, J.J.P. (2019), "A multilevel integrated framework of firm HR practices, individual ambidexterity, and organizational ambidexterity", *Journal of Management*, Vol. 45 No. 7, pp. 3009-3034, doi: 10.1177/0149206318776775.

Nowacki, C. and Monk, A. (2020), "Ambidexterity in government: the influence of different types of legitimacy on innovation", *Research Policy*, Vol. 49 No. 1, 103840, doi: 10.1016/j.respol.2019.103840.

Okatan, K. (2012), "Managing knowledge for innovation and intra networking: a case study", *Procedia – Social and Behavioral Sciences*, Vol. 62, pp. 59-63, doi: 10.1016/j.sbspro.2012.09.012.

O'Reilly, C.A. and Tushman, M.L. (2008), "Ambidexterity as a dynamic capability: resolving the innovator's dilemma", *Research in Organizational Behavior*, Vol. 28, pp. 185-206, doi: 10.1016/j.riob.2008.06.002.

O'Reilly, C.A. and Tushman, M.L. (2011), "Organizational ambidexterity in action: how managers explore and exploit", *California Management Review*, Vol. 53 No. 4, pp. 5-22, doi: 10.1525/cmr.2011.53.4.5.

Panetti, E., Parmentola, A., Ferretti, M. and Reynolds, E.B. (2019), "Exploring the relational dimension in a smart innovation ecosystem: a comprehensive framework to define the network structure and the network portfolio", *The Journal of Technology Transfer*, Vol. 45 No. 6, pp. 1775-1796, doi: 10.1007/s10961-019-09735-y.

Podsakoff, P.M. and Organ, D.W. (1986), "Self-reports in organizational research: problems and prospects", *Journal of Management*, Vol. 12 No. 4, pp. 531-544, doi: 10.1177/014920638601200408.

Podsakoff, P.M., MacKenzie, S.B. and Podsakoff, N.P. (2012), "Sources of method bias in social science research and recommendations on how to control it", *Annual Review of Psychology*, Vol. 63 No. 1, pp. 539-569, doi: 10.1146/annurev-psych-120710-100452.

Porath, C.L., Foulk, T. and Erez, A. (2015), "How incivility hijacks performance: it robs cognitive resources, increases dysfunctional behavior, and infects team dynamics and functioning", *Organizational Dynamics*, Vol. 44 No. 4, pp. 258-265, doi: 10.1016/j.orgdyn.2015.09.002.

Reypens, C., Lievens, A. and Blazevic, V. (2021), "Hybrid Orchestration in Multi-stakeholder Innovation Networks: practices of mobilizing multiple, diverse stakeholders across organizational boundaries", *Organization Studies*, Vol. 42 No. 1, pp. 61-83, doi: 10.1177/0170840619868268.

Roche, O., Freundlich, F., Shipper, F. and Manz, C.C. (2018), "Mondragon's amorphous network structure: 'Making the whole truly greater than the sum of its parts'", *Organizational Dynamics*, Vol. 47 No. 3, pp. 155-164, doi: 10.1016/j.orgdyn.2018.01.001.

Ryu, E. and West, S.G. (2009), "Level-specific evaluation of model fit in multilevel structural equation modeling", *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 16 No. 4, pp. 583-601, doi: 10.1080/10705510903203466.

Schoemaker, P.J.H., Heaton, S. and Teece, D. (2018), "Innovation, dynamic capabilities, and leadership", *California Management Review*, Vol. 61 No. 1, pp. 15-42, doi: 10.1177/0008125618790246.

Taheri, M. and van Geenhuizen, M. (2019), "Knowledge relationships of university spin-off firms: contrasting dynamics in global reach", *Technological Forecasting and Social Change*, Vol. 144, December 2018, pp. 193-204, doi: 10.1016/j.techfore.2019.03.013.

Teece, D.J. (2017), "A capability theory of the firm: an economics and (Strategic) management perspective", *New Zealand Economic Papers*, Vol. 53 No. 1, pp. 1-43, doi: 10.1080/00779954.2017.1371208.

Tikas, G.D. (2023), "Team innovation capability: scale development and validation", *Technovation*, Vol. 126, June, 102773, doi: 10.1016/j.technovation.2023.102773.

Töpfer, S., Cantner, U. and Graf, H. (2017), "Structural dynamics of innovation networks in German Leading-Edge Clusters", *The Journal of Technology Transfer*, Vol. 44 No. 6, pp. 1-24, doi: 10.1007/s10961-017-9642-4.

Troise, C., Santoro, G., Jones, P. and Bresciani, S. (2023), "Small and medium enterprises and sustainable business models: exploring enabling factors for adoption", *Journal of Management and Organization*, Vol. 30 No. 3, pp. 452-465, doi: 10.1017/jmo.2023.45.

Troisi, O., Visvizi, A. and Grimaldi, M. (2024), "The different shades of innovation emergence in smart service systems: the case of Italian cluster for aerospace technology", *Journal of Business and Industrial Marketing*, Vol. 39 No. 6, pp. 1105-1129, doi: 10.1108/JBIM-02-2020-0091.

van Lieshout, J.W.F.C., van der Velden, J.M., Blomme, R.J. and Peters, P. (2021), "The interrelatedness of organizational ambidexterity, dynamic capabilities and open innovation: a conceptual model towards a competitive advantage", *European Journal of Management Studies*, Vol. 26 Nos 2/3, pp. 39-62, doi: 10.1108/ejms-01-2021-0007.

Viswanathan, M. and Kayande, U. (2012), "Commentary on 'common method bias in marketing: causes, mechanisms, and procedural remedies'", *Journal of Retailing*, Vol. 88 No. 4, pp. 556-562, doi: 10.1016/j.jretai.2012.10.002.

Wei, Z., Yi, Y. and Guo, H. (2014a), "Organizational learning ambidexterity, strategic flexibility, and new product development", *Journal of Product Innovation Management*, Vol. 31 No. 4, pp. 832-847, doi: 10.1111/jpim.12126.

Wei, Z., Zhao, J. and Zhang, C. (2014b), "Organizational ambidexterity, market orientation, and firm performance", *Journal of Engineering and Technology Management – JET-M*, Vol. 33, pp. 134-153, doi: 10.1016/j.jengtecman.2014.06.001.

Wilden, R., Hohberger, J., Devinney, T.M. and Lavie, D. (2018), "Revisiting James March (1991): whither exploration and exploitation?", *Strategic Organization*, Vol. 16 No. 3, pp. 352-369, doi: 10.1177/1476127018765031.

Wilhelm, H., Maurer, I. and Ebers, M. (2022), "When are dynamic capabilities routine A mixed-methods configurational Analysis.pdf", *Journal of Management Studies*, Vol. 59 No. 6, pp. 1531-1562, doi: 10.1111/joms.12789.

Xie, L., Zhou, J., Zong, Q. and Lu, Q. (2020), "Gender diversity in R&D teams and innovation efficiency: role of the innovation context☆", *Research Policy*, Vol. 49 No. 1, 103885, doi: 10.1016/j.respol.2019.103885.

Yamashita, N. (2021), "Economic crisis and innovation capacity of Japan: evidence from cross-country patent citations", *Technovation*, Vol. 101, October 2020, 102208, doi: 10.1016/j.technovation.2020.102208.

Yang, Z., Zhou, X. and Zhang, P. (2015), "Discipline versus passion: collectivism, centralization, and ambidextrous innovation", *Asia Pacific Journal of Management*, Vol. 32 No. 3, pp. 745-769, doi: 10.1007/s10490-014-9396-6.

Zhang, W., Zhao, Y., Wang, D., Wang, H. and Li, J. (2017), "Ambidextrous search and product innovation: moderating effects of resource and structural attributes", *The Journal of Technology Transfer*, Vol. 44 No. 4, pp. 1-22, doi: 10.1007/s10961-017-9641-5.

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