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Design thinking and public sector innovation: The divergent effects of risk-taking, cognitive empathy and emotional empathy on individual performance☆

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ABSTRACT

Traits that predict whether an employee will generate promising new ideas do not necessarily predict that they will also implement those ideas. This is especially relevant within the public sector, which is typically more risk averse than the private sector, and where barriers to innovation include staff resistance, rigid organizational structures, and a lack of shared innovation goals. To shed light on why some public sector employees are better intrapreneurs than others, we examine the role of risk-taking, emotional empathy, and cognitive empathy on the likelihood of innovation implementation. Using a sample of public sector employees who attended a prominent design thinking bootcamp run by the Bangladeshi Prime Ministers Office, results indicate that individuals are more likely to implement their innovative ideas if they have higher cognitive empathy and risk-taking propensity, but lower emotional empathy. We find evidence for the 'empathy divergence thesis' within a public sector setting, extending growing evidence from neuroscience and psychology that cognitive and emotional empathy are distinct processes with divergent effects on behavior. In sum, we provide a nuanced understanding of the overall effect of three important individual level traits on the likelihood of innovation implementation among public sector employees.

1. Introduction

Researchers have long recognized the important role of innovation in public service development (Desmarchelier et al., 2019; Osborne and Brown, 2011; Torfing, 2019; Fuglsang and Hansen, 2022), including the role of innovation in overcoming societal challenges and meeting citizens' needs (Fuglsang and Rønning, 2014; Torfing, 2019; Fuglsang and Hansen, 2022). These insights have coincided with the proliferation of public sector innovation initiatives, including 'Living Labs' (Fuglsang and Hansen, 2022; Engels et al., 2019), 'Public Sector Innovation Labs' (McGann et al., 2018), and innovation and entrepreneurship focused 'Bootcamps' (Van Winden and Carvalho, 2019; Ventres-Pake, 2021), which aim to tackle societal challenges ranging from improving satisfaction with public services to reducing crime, poverty, and healthcare costs (McGann et al., 2018; Engels et al., 2019).

However, successful implementation of public sector innovations is difficult, especially as the innovation process is influenced by individual, organizational, national, and international factors and barriers (Borins, 2018; Bysted and Hansen, 2015; Demircioglu and Audretsch, 2017; Suzuki and Demircioglu, 2019; Demircioglu, 2020). Cinar et al. (2019)

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outline the barriers to public sector innovation processes, revealing that most occur in the implementation phase. This has prompted calls for new research directions, with Demircioglu (2020 p. 1853) arguing that "we now need more studies that test *why* some public sector employees are more innovative than others." By emphasizing the individual-level determinants of innovation implementation, his appeal mirrors similar, largely unanswered calls in adjacent fields to understand which traits and conditions contribute to making successful public sector entrepreneurs, intrapreneurs, or innovators (e.g., Morris and Jones, 1999; Klein et al., 2010, 2013; Tremml, 2019).

Design thinking, which places empathy as central to the innovation process (Clarke and Craft, 2019), has arguably become the dominant paradigm underpinning most public sector innovation initiatives (McGann et al., 2018; Kieboom, 2014; Lewis et al., 2020). Defined as "an array of mindsets, methods and practices to help people become more productive, creative and innovative" (Liedtka and Bennett, 2013; cited in Ney and Meinel, 2019, p. 2), design thinking is considered a potent means of innovating to solve complex issues and address customer needs (Roper et al., 2016; Pfotenhauer et al., 2019). Yet to stimulate public sector innovation, training public servants in design thinking is by no means a panacea (Clarke and Craft, 2019; Lewis et al., 2020). For instance, by prioritizing the value of the end-user's feedback above all else (user centrism), design thinking is naïve to—and thus ill-equipped to deal with—many barriers to innovation, including public sector politics and processes that may stifle eventual implementation (Clarke and Craft, 2019).

This raises an important practical question: why are some public sector employees better able to convert design thinking training into implemented public sector innovations than others? The paucity of research into this and related questions is unfortunate, but not for lack of interest. Innovation studies have long been interested in whether particular traits contribute to the innovativeness or creative output of individuals within unique yet important contextual domains other than corporations. These range from the entrepreneurial outputs of bootcamp participants in India (Hasan and Koning, 2019), to the innovative outputs of prospective consumer-innovators (Stock et al., 2016) or established inventors (Zwick et al., 2017).

Informed by entrepreneurship, creativity and innovation studies, this article investigates the role of two largely 'taken-for-granted' traits (see Micheli et al., 2019; Bernier and Hafsi, 2007)—risk-taking propensity and empathy—that are central to theories within these fields, yet are contentious among scholars, and remain under researched at the individual-level. While the propensity for *risk-taking* has been emphasized as an essential trait of public sector intrapreneurs by some (e.g., Schneider et al., 1995; Kearney et al., 2009; Demircioglu and Chowdhury, 2021), others argue that it is a largely unnecessary or peripherally useful trait (e.g., Potts and Kastelle, 2010; Roberts, 1992), and still others suggest that it is a trait that is punished within public sector organizations (Morris and Jones, 1999; Demircioglu, 2018).

Besides risk-taking, *empathy* is another critical trait required by design thinkers to successfully innovate (e.g., Brown and Katz, 2011; Liedtka, 2015; Micheli et al., 2019; Seidel and Fixson, 2013; Stanford D. School, 2018). To illustrate, Clarke and Craft (2019, p.9) state that "design thinking has come to prioritize empathy for the user as a key characteristic of the designer." Yet in contrast to design thinking proponents, neuroscientists and psychologists have accumulated a large body of evidence that recognizes empathy as not one but multiple, independent traits: specifically dividing it into emotional and cognitive forms (Shamay-Tsoory et al., 2009; Mitchell et al., 2006; Smith, 2006). Moreover, advances in psychology have uncovered evidence that supports not only the potential 'dark-sides' of certain forms of empathy, but also their divergent effects in a variety of narrow settings (Galinsky et al., 2008; Gilin et al., 2013; for a recent review, see Weisz and Cikara, 2021). For example, cognitive empathy tends to facilitate prosocial behavior, while emotional empathy inhibits it in certain contexts (Weisz and Cikara, 2021). This *empathy divergence thesis* has yet to be tested in relation to individuals' innovativeness and, more specifically, has yet to be tested within the context of public sector innovation.

Accordingly, we test the importance of *risk-taking propensity*, *emotional empathy*, and *cognitive empathy* on *innovation implementation* among public sector employees by using a sample of 422 employees who attended a prominent design thinking bootcamp run by the Bangladeshi Prime Minister's Office along with the Cabinet Division and Ministry of Public Administration through an initiative called Aspire to Innovate (*a2i*). The primary goal of the program was "to ensure easy, affordable and reliable access to quality public services for all citizens of Bangladesh" and to support the government's ability to "integrat[e] new, whole-of-society approaches to achieve the Sustainable Development Goals" (Aspire to Innovate, 2021). Our findings reveal that risk-taking propensity is a positive determinant of innovation implementation. Moreover, our findings support the 'empathy divergence thesis' by revealing that emotional empathy is a negative determinant and cognitive empathy a positive determinant of innovation implementation. Besides controlling for a range of contextual factors and investigating the relative influence of each independent variable, robustness checks further support our predictions.

As innovation is highly context dependent (Demircioglu, 2020), we justify our focus on a developing country setting for theoretical and normative reasons. First, despite many overlaps between developing and developed country public sector contexts—for example, the use of design thinking for public sector innovation initiatives has burgeoned in both settings,[1] with each experiencing many of the same innovation barriers (Wyatt et al., 2021; Cinar et al., 2021)—the developing country context differs in important ways (Cinar et al., 2022). In particular, public sector innovation systems in developing countries are less likely to involve contracting out parts of the innovation process to external partners, and are less formalized overall (Aubert, 2005; Tan, 2010). This makes the developing country context an ideal setting for investigating individual employees' abilities at overcoming a wide range of barriers throughout the innovation process to implement their ideas. Second, there is normative concern for reducing international inequality (Kaplinsky and Kraemer-Mbula, 2022; Freeman, 2001). To address this, focusing on the determinants of public sector innovativeness in developing countries is important for several reasons. Compared to developed countries, the public sector in developing countries arguably plays a larger role in direct service provision to citizens, including those in informal employment (Kurlantzick, 2016; Kaplinsky and Kraemer-Mbula, 2022), experiences more barriers to innovation including corruption (Mungiu-Pippidi, 2015), and is responsible for the wellbeing of more of the world's poor and underprivileged (IMF, 2021). Further, in this context, the implementation of even modestly innovative ideas can make a huge difference: consider for example, the diffusion of mosquito nets used to fight malaria (Aubert, 2010). Despite these justifications, it remains that the innovativeness of public sector employees within developing countries has received little attention outside of case studies (for a recent exception see Williams and Yecalo-Tecle, 2020), especially when compared to their developed country counterparts (e.g., Arundel et al., 2019; Bloch, 2011; Bloch and Bugge, 2013; Clausen et al., 2020; Gault, 2018; Wipulanusat et al., 2018; Lapuente and Suzuki, 2020; Demircioglu and Audretsch, 2017; Demircioglu, 2020).[2]

The rest of this article is structured as follows. In Section 2, we develop theory and hypotheses linking individual-level risk-taking propensity and empathy traits on creative, innovative, and

[1] For example, the UK Department of International Development (DFID) partnered with IDEO.org, a design thinking consultancy, to launch *Amplify*, a design-thinking program to tackle challenges in developing countries alongside local public sector organizations (Wyatt et al., 2021).

[2] Reviews by Voorberg et al. (2015) and De Vries et al. (2016) reveal that most public sector innovation studies were undertaken in the United States and European Union.

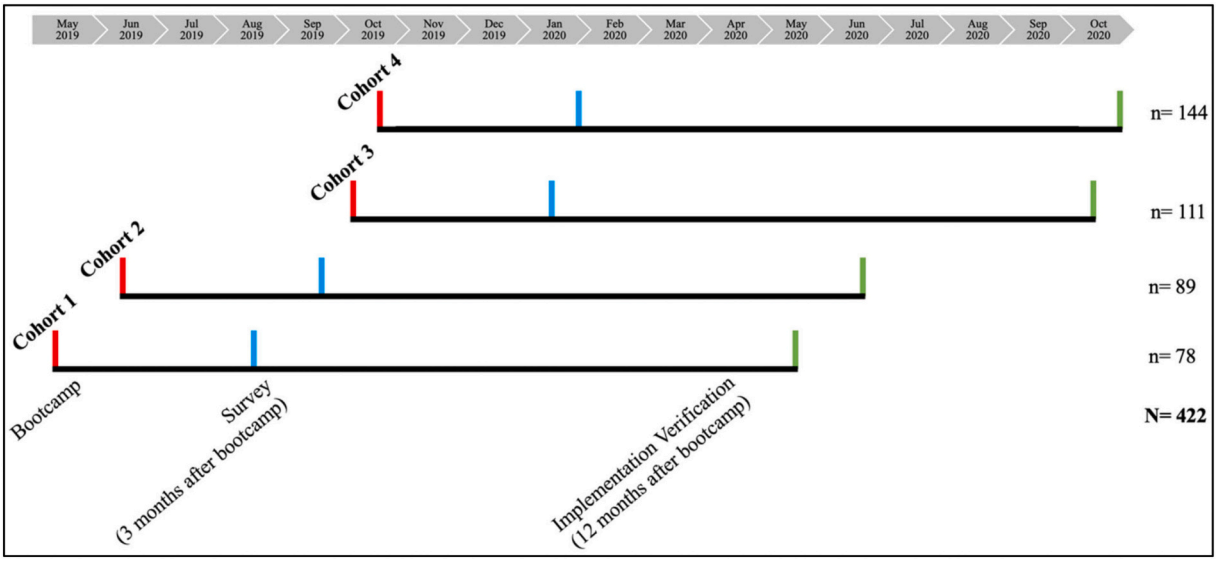


Fig. 1. Study design.

entrepreneurial outcomes in the context of public sector innovation. Section 3 presents our data and empirical strategy. Section 4 discusses our analysis and results. Our conclusions are discussed in Section 5.

2. Theory and hypotheses

2.1. Public sector innovativeness

Bloch (2011, p. 14) defines public sector innovation as "new or significant changes to services and goods, operational processes, organizational methods, or the way your organization communicates with users", adding that "innovations must be new to your organization, although they can have been developed by others." The public sector innovation process can be divided into four phases: idea generation, design and development, implementation, and sustainment (Cinar et al., 2019). Barriers impede progress from one phase of the innovation process to another and are defined as obstacles that can be overcome through effort, creativity, changes in thinking or prioritization, and related shifts in resources (Moser and Ekstrom, 2010).

Most empirical studies into the innovativeness of public sector employees utilize one of a handful of datasets designed for public sector organizations (e.g., Innobarometer for the European Union, Measuring Public Innovation in the Nordic Countries project, and the Australian Public Service Commission) and focus on developed country contexts (Arundel et al., 2019; Bloch, 2011; Bloch and Bugge, 2013; Clausen et al., 2020; Gault, 2018; Wipulanusat et al., 2018; Voorberg et al., 2015; De Vries et al., 2016). Yet even those studies investigating the role of individual traits measure innovativeness at the organization- or country-level (e.g., Clausen et al., 2020), or if measured at the individual-level, through self-reported scales (e.g., Lapuente and Suzuki, 2020). Two notable exceptions are Demircioglu and Audretsch (2017) and Demircioglu (2020), who use Australian Public Service Commission data to measure the innovation likelihood of workgroups, adopting a dichotomous dependent variable: "In the last 12 months, has your work group implemented any innovations? (Yes/No)". Moreover, we are aware of only one study (i.e., Lapuente and Suzuki, 2020) that measures individual-level innovativeness within the public sector, but through individual attitudes towards innovation (e.g., receptiveness to new ideas) rather than direct innovation outputs. Given that relatively few public sector innovativeness studies test the impact of individual-level traits on individual-level outcomes, we turn to the related fields of entrepreneurship, creativity, and innovation to build our theoretical framework and hypotheses.

2.2. Individual-level innovativeness and overcoming barriers to implementation

Although entrepreneurship is usually associated with new venture creation and start-ups, it also plays an important role in established organizations (Lumpkin, 2012; Stevenson and Jarillo, 1990). In this context, it is known as intrapreneurship, corporate entrepreneurship, and internal corporate venturing (Burgelman, 1983; Guth and Ginsberg, 1990; Lumpkin and Dess, 1996; Pinchot, 1985). Intrapreneurs are defined as "those who take hands-on responsibility for creating innovation of any kind within an organization" (Pinchot, 1985, p. xi), demonstrating that *intrapreneurship* has been closely associated with *innovation* since the term first came into use. To date, we have a rich understanding of which traits are associated with intrapreneurs in commercial settings (e.g., Chen and Nadkarni, 2017; Hornsby et al., 2009; Kacperczyk, 2012), but comparatively little is known about intrapreneurs within *public sector* organizations,[3] especially which individual traits predict employees' ability to implement their innovative ideas (Cinar et al., 2019; De Vries et al., 2016; Demircioglu, 2020; Tremml, 2019; Demircioglu and Chowdhury, 2021). Filling this knowledge gap is important because intrapreneurs face unique challenges in driving public sector innovation within their organizations. In a recent review of barriers to public sector innovation processes, Cinar et al. (2019) identify 235 such factors across all phases of the innovation process, ranging from highly rigid organizational structures, to cultural resistance, to employees' inability to agree on common goals. These findings are echoed by Tremml (2021) who review barriers to entrepreneurship within the public sector, finding that, in the absence of clear incentives, intrapreneurs are often considered "outsiders" who burden colleagues without benefiting them (p. 1535).

According to Cinar et al. (2019), most innovation barriers identified occur within the implementation phase (55 %), and by the time that successful implementation has occurred, almost all (96 %) of the

[3] Recognizing that concepts and findings from the private sector cannot easily be generalized to the public sector (Kearney et al., 2008, 2010; Kraus et al., 2019), terms such as *public sector intrapreneurs* (Hale and Woronkowicz, 2021), *public sector corporate entrepreneurs* (Kearney et al., 2009), and *public entrepreneurs* (Diefenbach, 2011) have been used to highlight how intrapreneurs within the public sector differ.

barriers identified may have been cumulatively encountered (note that <10 % of barriers relate to idea generation and selection, but most literature focuses on outcomes pertaining to this initial phase). Scholars typically conceptualize barriers as existing when something is 'missing' that, from a normative perspective, should be present (Biesbroek et al., 2013, 2014). For example, a lack of resources, skills, and information. This structural-functional view perceives barriers as reified and static entities, whereby identifying the many barriers that exist is the first step to overcoming them (see Biesbroek et al., 2013).

In contrast, barriers can be conceptualized as 'impasses' that emerge between actors. This social-mechanismic view foregrounds the importance of social interactions between actors with different perspectives in which problems and solutions are discussed so that impasses may be overcome (Biesbroek et al., 2014). Indeed, successful implementation involves the interplay between many actors with various roles in the innovation process (Bloch and Bugge, 2013; Schumpeter, 1934). Unlike in many commercial settings, public sector intrapreneurs tend to navigate many internal and external actors with limited autonomy in decision making, varying incentive structures, and objectives that are typically less clear, changeable, ill specified, and qualitative in nature (Bloch and Bugge, 2013; Klein et al., 2013; Vivona et al., 2020). Accordingly, we adopt the latter view as our theoretical foundation because, rather than focus on barriers as static 'things', it foregrounds the role of individual actors' interactions, and thus their ability to influence the 'changeability' of barriers through their actions.[4]

2.2.1. 'Framing' and 'fixing' activities

As the innovation process advances, newly revealed innovation barriers pertain less to user interactions and more to interactions with a wider array of other actors including colleagues and various decision makers (Cinar et al., 2019; Meijer, 2014). Indeed, innovators frequently manage the competing perspectives of various actors (Tjosvold, 1998; West, 2002), addressing and anticipating these actors' disparate needs and preferences, while trying not to lose sight of their original vision (Liedtka, 2014; Loewenstein and Angner, 2003). This 'balancing act' becomes more important as the process advances, as employees are more likely to encounter negative resistance from additional actors with additional needs and preferences, with these newly revealed barriers culminating in the run-up to implementation (Cinar et al., 2019).

In relation to the increasing importance of this 'balancing act' as more barriers are revealed, we refer to two strategies that employees can use to overcome innovation barriers: '*framing*' and '*fixing*'. 'Framing' involves using persuasion to overcome resistance, such as by highlighting the benefits of an idea or providing training to gain 'buy-in' from others (Meijer, 2015; Cinar et al., 2021). Within our context, 'framing' activities may include attempts at modifying the perspectives of key stakeholders to overcome cultural barriers or to align their views in support of a given idea. Conversely, 'fixing' involves providing new resources and modifying one's approach, such as by revising the original idea or seeking new funding sources (Meijer, 2015; Cinar et al., 2021). Examples of 'fixing' activities within our context include improving technological systems, navigating legal constraints, and applying for grants to support a given idea.

We propose that traits associated with an employee's ability to competently engage in *both* activities will increase the likelihood that they can overcome barriers to implement their ideas. Consider that a public sector employee who is good at fixing but not framing may be too flexible and accommodating of others' suggestions, and thus lose sight of their original idea and vision. Conversely, an employee who is good at framing but not fixing may be influential with colleagues but too rigid, and thus incapable of satisfactorily adapting their idea to newly revealed constraints.

2.3. Individual traits and innovation implementation

Individual traits can enable or hinder an employee's ability to overcome barriers to public sector innovation and entrepreneurship. Two overlapping streams of literature investigate early- versus late-stage outcomes of the innovation process. Studies in the entrepreneurship literature identify the importance of individual traits on early-stage outcomes, such as the number of ideas generated and their quality, and on late-stage outcomes, such as venture creation and idea implementation (e.g., Gielnik et al., 2012; Hornsby et al., 2009; Kier and McMullen, 2018; Rauch and Frese, 2007). Conversely, within the fields of creativity and innovation, studies identify the role of individual traits on early-stage outcomes such as creative behavior, and on late-stage outcomes such as innovation implementation frequency (e.g., Baer, 2012; Kraiczy et al., 2015). Yet most of these studies have focused on the *early stages* of the innovation process (e.g., idea generation, idea quality and opportunity recognition) compared with the *later stages* of the process, especially whether individuals' ideas are converted into implemented innovations (Anderson et al., 2014; Baer, 2012).[5] This imbalance is non-trivial because entrepreneurial innovation requires different skills and traits at different phases (Baer, 2012; Perry-Smith and Mannucci, 2017; Stock et al., 2016), with individuals possessing some of these traits but not others. Furthermore, important skills and traits may help performance in one phase but hinder it during another as certain traits may reveal contradictions, tensions, and trade-offs, making it rare and difficult for an individual to successfully move through all phases of the process (Perry-Smith and Mannucci, 2017). By focusing on implementation, we seek a better understanding of whether a given trait has a positive or negative effect on overall employee innovativeness.[6] To examine this overall effect, we focus on the impact of two traits on innovation implementation likelihood: *risk-taking propensity* and *empathy*. We focus on these traits because they are central to both entrepreneurship and innovation theory, yet their importance in explaining public sector employees' ability to turn ideas into innovations, in both absolute and relative terms, remains underexplored.

2.3.1. Individual-level risk-taking

Notwithstanding the centrality of risk-taking to entrepreneurship theory (Knight, 1921; Schumpeter, 1934; Rauch et al., 2009), views vary widely on its importance at the individual level in the public sector (Diefenbach, 2011). Theoretically, some perceive it as peripheral (Roberts, 1992), while others argue that it is critical (Schneider et al., 1995; Kearney et al., 2009). Still others suggest that risk-taking individuals are punished within public sector organizations (Morris and Jones, 1999; Demircioglu, 2018), or that there is a sweet spot where risk-taking is balanced with other traits (Currie et al., 2008). Empirically, an individual's propensity for risk-taking within public sector

[4] Supporting this position, in their recent multi-country exploration into innovation barriers, Cinar et al. (2021) conclude that *interaction specific* barriers—that is, barriers shaped by relational interactions within the innovation process—followed by *organizational* barriers—for example, internal resistance and lack of support—were by far the most common forms of barriers encountered by public sector employees. In contrast, *contextual* barriers beyond the influence of public sector employees and their organizations were revealed much less frequently.

[5] Occasionally, researchers have focused on early- and late-stage innovation outcomes in a single study (e.g., Stock et al., 2016).

[6] Focusing on late-stage outcomes, such as implementation, is especially insightful when considering that the innovation process is non-linear and iterative. Late-stage activities (e.g., championing) imply not only the successful navigation of early-stage activities (e.g., idea generation), but potentially even the navigation of multiple rounds of earlier activities. In sum, an employee's ability to implement their ideas also indicates their ability to overcome barriers associated with early- and late-stage activities, and thus their overall innovativeness.

organizations has been associated with their exploration (but not exploitation) behaviors (Kraus et al., 2019) and their department's orientation towards public value creation (Diefenbach, 2011), but we know little about its overall effect on public sector intrapreneurs' ability to convert their own ideas into public sector innovations.

2.3.2. Individual-level empathy

Despite the theoretical importance of empathy to entrepreneurship theory (Chiles et al., 2010; Khalid and Sekiguchi, 2018; McMullen, 2015; Packard and Burnham, 2021; Prandelli et al., 2016) and human centered innovation (Brown and Katz, 2011; Liedtka, 2015; Micheli et al., 2019; Seidel and Fixson, 2013; Stanford D. School, 2018) we know of no empirical investigations into its role in public sector employees' abilities to turn ideas into public sector innovations. Further, while existing studies measure empathy as a single construct (e.g., Kier and McMullen, 2018; Prandelli et al., 2016), advances in neuroscience and psychology support the view that empathy actually consists of two distinct 'emotional' and 'cognitive' forms (Davis, 2018; Packard and Burnham, 2021; Smith, 2006). Furthermore, recent advances in these fields have uncovered evidence that supports their divergent effects in a variety of narrow settings (Galinsky et al., 2008; Gilin et al., 2013; for a recent review, see Weisz and Cikara, 2021). However, the so-called 'empathy divergence thesis' has yet to be tested in the context of individual-level innovativeness within a public sector context.

2.4. Risk-taking propensity and innovation implementation

Risk-taking can be divided into two categories (Rauch and Frese, 2007): a behavior that stems from an innate dispositional trait such as risk-taking propensity (e.g., Stewart and Roth, 2001), or an output of a context specific judgment process (e.g., Kahneman and Tversky, 1979). Focusing on risk-taking as a trait, we define risk-taking propensity as an individual's *willingness* to engage in behaviors with uncertain outcomes (Baer et al., 2022; Keh et al., 2002; Kraiczy et al., 2015).

We argue that risk-taking propensity is positively related to innovation implementation likelihood because it is conducive to both 'framing' and 'fixing' activities that involve relevant stakeholders. 'Framing' activities involve overcoming barriers by reorienting others' thinking about issues in a manner that supports implementation efforts (Meijer, 2015). Yet these activities carry significant risks to the innovator. They may not be supported by management, and may involve challenging the organization's strategy, culture, and existing norms (Heinonen and Toivonen, 2008). Further, uncertainty is high when seeking to persuade others to implement an idea, and the employee may not only lose their investment of time and effort, but also their reputation and the trust of colleagues (Ferrero and Bessière, 2016). Given such risks, it is tempting for an employee to defer critical 'framing' activities in favor of less risky actions, such as doing additional user interviews. We posit that higher risk-taking propensity is required to overcome this inertia, especially as public sector organizational cultures tend to be more risk-averse than their private sector counterparts (Brown and Osborne, 2013). Indeed, existing evidence indicates that, ceteris paribus, individuals with higher risk-taking propensity weigh positive potential outcomes from interactions more highly (Brockhaus, 1980; Vlek and Stallen, 1980; Schneider and Lopes, 1986), are more likely to initiate risky negotiations in the pursuit of their goals (Volkema and Fleck, 2012), and are more likely to strategically optimize their requests of others (e.g., ask for more rather than less of what they desire; Kapoutsis et al., 2013).

'Fixing' activities require modifying one's approach by overcoming and working around barriers by reconfiguring or finding new resources. We posit that risk-taking propensity bolsters the flexibility and creativity required from employees to engage in 'fixing' activities, especially in the face of increased negative feedback as the innovation process advances. Indeed, existing evidence indicates that risk-taking propensity correlates strongly with general flexibility, learning from errors, and creative performance behaviors including the provision of novel yet practical suggestions (Rybowiak et al., 1999; Dewett, 2006). Risk-taking propensity is also positively associated with an individual's ability to overcome career setbacks and recover from mistakes (Moenkemeyer et al., 2012), with these connections also appearing in literature on corporate entrepreneurs' responses to failure (Corbett et al., 2007; Shepherd et al., 2009). In sum, considering the effect of risk-taking propensity on implementation, we posit that:

Hypothesis 1. Risk-taking propensity is positively related to innovation implementation likelihood for public sector employees.

2.5. Empathy divergence thesis

Hypotheses two and three are based on the 'empathy divergence thesis', which posits that both emotional empathy (the ability to automatically share another person's emotions; Smith, 2006) and cognitive empathy (the ability to deliberately see the world from another person's viewpoint; Smith, 2006) can co-occur, but also occur independently, allowing us to categorize individuals as high or low in both forms of empathy, or high in one and low in the other (Batson, 2011). Accordingly emotional and cognitive empathy can be categorized as separate constructs and distinct processes with divergent effects on individual behavior (Longmire and Harrison, 2018; Weisz and Cikara, 2021). Here we differ from previous entrepreneurship and innovation studies that measure empathy as a unidimensional construct (e.g., Kier and McMullen, 2018), or study just one form of empathy (e.g., Prandelli et al., 2016). Additionally, our thesis contrasts with more recent studies that recognize cognitive and emotional forms of empathy as separate but treat them as providing parallel routes to the same outcomes (e.g., Bacq and Alt, 2018).

2.6. Emotional empathy and innovation implementation

Emotional empathy is a fast, automatic, and reflective process, often depicted as emotional contagion or experience sharing, specifically the propensity to 'catch', 'share', or 'feel' another's emotions (Hatfield et al., 1993; Smith, 2006; Weisz and Cikara, 2021).

We argue that emotional empathy impedes innovation implementation likelihood because it undermines 'framing' and 'fixing' activities. 'Framing' activities require persuading others into changing their minds to support implementation. Due to the activation of caregiving pathways, an employee with higher emotional empathy is more likely to support those in distress—even if those people's needs are not as great as others' needs, doing so disadvantages others, and principles of justice or fairness are abandoned in the process (Batson et al., 1995; Buffone and Poulin, 2014; König et al., 2020). Moreover, higher emotional empathy may be biased towards an in-group (Breithaupt, 2012). This trait undermines 'framing' activities because, rather than facilitating an employee's ability to persuade others to support implementation, high emotional empathy increases the tendency of an employee to capitulate to positions held by others, especially their closest or most negative colleagues. For instance, as the innovation process advances, more barriers are revealed and the employee encounters greater negative resistance, they may be unduly swayed by more negative or upset colleagues and decision makers, putting these actors' views above their own and those of users uncovered earlier in the innovation process. Overriding these needs to accommodate their ingroup could undermine the product-market fit of the potential innovation, reducing its likelihood of successful implementation.

We also argue that high emotional empathy reduces one's ability to engage in discretionary 'fixing' efforts. Employees possess a diverse array of personal resources on which they draw to effectively achieve their goals (Hobfoll, 2001). We posit that such resources—which can be emotional or physical—are crucial to driving the innovation process, especially discretionary 'fixing' activities that necessitate expending

valuable personal resources on developing novel solutions to newly revealed barriers. Yet, higher emotional empathy, especially 'catching' the negative emotions of others, is shown to correlate positively with emotional exhaustion (Barsade et al., 2018; Miller et al., 1988), which in turn, correlates with increased resource conservation, including less engagement in discretionary 'extra-role performance' behaviors that are not required in formal job descriptions (Ain et al., 2022) and reduced interest in personal accomplishment (Halbesleben and Bowler, 2007; Demerouti and Cropanzano, 2010). Accordingly, as more innovation barriers are revealed, an employee with higher emotional empathy is more likely to catch negative emotions from others, experience greater emotional exhaustion, and, as a result, be less likely to engage in discretionary 'fixing' activities. Taken together, we posit the following hypothesis on the effect of emotional empathy on implementation:

Hypothesis 2. Emotional empathy is negatively related to innovation implementation likelihood for public sector employees.

2.7. Cognitive empathy and innovation implementation

Cognitive empathy is the ability to understand the inner experiences and feelings of others, infer their perceptions, and view the outside world from their perspective (Dymond, 1950; Parker et al., 2008).

We argue that cognitive empathy is positively related to innovation implementation likelihood because it supports both 'framing' and 'fixing' activities. As the innovation process progresses, and the potential intrapreneur encounters greater negative resistance from colleagues and other stakeholders, the need to understand, strategically cooperate with, and ultimately persuade diverse stakeholders increases. We posit that cognitive empathy is conducive to such 'framing' tasks because it can improve an individual's ability to assess the complexities in their environment when interacting with others (DeAngelo and McCannon, 2017). In particular, individuals with higher cognitive empathy are better able to recognize the incentives of multiple stakeholders and can use this information to generate superior outcomes relative to peers with lower levels of cognitive empathy. In sum, high cognitive empathy enhances the relative ability of intrapreneurs to both cooperate and compete in complex situations (Artinger et al., 2014; DeAngelo and McCannon, 2017), suggesting that this trait may help them accommodate and use the diverse perspectives of others without losing sight of their original goal, and thus ultimately to implement their particular innovation.

Higher cognitive empathy is also useful when it comes to 'fixing' activities that require modifying one's approach by overcoming and working around barriers. In particular, cognitive empathy allows an employee to widen their understanding of multiple facets of users', colleagues, and other stakeholders' experiences (Prandelli et al., 2016). This broader understanding of multiple stakeholders enhances the individual's ability to perceive new connections between people, events, and trends, and thus improve their entrepreneurial imagination (Kor et al., 2007), ability to accurately recognize new opportunities (Prandelli et al., 2016), and develop richer prototypes (Baron, 2006) to ultimately overcome the barriers to implementation that emerge. In sum, we posit the following hypothesis on the effect of cognitive empathy on implementation:

Hypothesis 3. Cognitive empathy is positively related to innovation implementation likelihood for public sector employees.

3. Empirical framework

3.1. Empirical setting

We test our hypotheses by studying a sample of public sector employees from Bangladesh who undertook a prominent design thinking training program led by the Prime Minister's Office under its *a2i* initiative, established in 2007 to encourage innovation among public sector employees aimed at improving "Services for All" citizens (UNDP, 2021). The five-day training followed a typical design thinking methodology and structure (i.e., empathize, define, ideate, prototype, test; Stanford D. School, 2018). By 2019, the *a2i* programs had trained over 70,000 civil servants from 43,000 government offices and are estimated to have resulted in saving Bangladeshi citizens over 1.92 billion days and over $8 billion (Aspire to Innovate, 2021; Chowdhury and Gillies, 2020).

We chose the design thinking bootcamp as our research setting for three reasons. First, as an inclusive whole-of-government program it was open to all public sector employees regardless of their place of work and paygrade and had strong support from top leadership, minimizing selection bias. Second, all attendees were given uniform skills training and language around innovation—for instance, mandating that innovations must meet 'TCV' criteria of reducing the *time*, *cost*, and number of *visits* it takes citizens to access services. Accordingly, the program provided an ideal platform for examining the role of innate individual traits (rather than learned behaviors), and reduced method bias by increasing response accuracy (MacKenzie and Podsakoff, 2012). Third, as the training program was well-resourced and documented, in addition to receiving adequate training, independent observers from the Prime Minister's Office followed up with every respondent and focused on maintaining accurate records. Such settings are rarely available in developing country contexts, making this an ideal one within which to test our hypotheses.

We collected data from individuals who attended one of four consecutive bootcamps at the local Divisional Commissioner's office. Across the four cohorts, a total of 3496 public sector employees attended. Each cohort received uniform training (e.g., identical content delivered over five-days by the same instructors). Within each cohort, participants came from an array of government departments, and had diverse backgrounds in relation to their education, rank, and tenure among other attributes.

As is typical of such bootcamps, besides covering design thinking concepts, participants engaged in design thinking activities (Stanford D. School, 2018). On day one, each participant was introduced to the design thinking methodology, generated initial hypotheses about a particular problem they could each solve, and developed their own preliminary service process simplification maps using the TCV criteria. On day two, each participant was randomly allocated into groups of 4–5 people and were instructed to conduct anonymous 'secret shopper' visits at a government department where none of the group members had previously worked. By anonymously assuming the role of an 'ordinary' citizen, each participant was expected to record insights from public sector employees, relevant customers and other constituents. On day three, each participant visited their own department. To maintain anonymity, individuals chose locations where they had no existing working relationships. Here, each participant was asked to anonymously observe interactions between employees and citizens and record any saliant insights that emerged. Over the final two days, participants moved from the 'empathize' and 'define' phases of the design thinking methodology to a greater focus on the 'ideate', 'prototype', and 'test' phases (Stanford D. School, 2018). Using recent insights, each participant was asked to revise their service process simplification map to better meet TCV criteria, turn their most promising ideas into initial low-fidelity prototypes to be developed, and finalize an innovation implementation plan. According to *a2i*, this plan is designed to "lock-in" each participant's focus on implementing an innovation that solves the specific problem they had identified during the bootcamp. To ensure that each participant built internal momentum around their problem and promising ideas, each was required to design and schedule "cascading workshops" (*a2i* terminology) within their own department and was encouraged to use them to continue working with a range of stakeholders including citizens, colleagues, and supervisors. Participants were free to determine who they would invite to each workshop, as well as how the workshops would be structured and when they would be

scheduled. Initial cascade workshops took place within 45–60 days of bootcamp attendance.

We developed a structured survey both in English and Bengali and sent it to attending public sector employees after they had completed bootcamp. Considering that we were only granted access to participants after each of the five-day sessions, we opted to leave a three- month window between each session and survey data collection to minimize the possibility that bootcamp attendance may influence independent variable scores over the short run (see Fig. 1). We note that *risk-taking propensity*, *emotional empathy*, and *cognitive empathy* are relatively fixed traits (e.g., Highhouse et al., 2022; Wallmark et al., 2018),[7] and that—to our knowledge—there is no evidence that design thinking training can alter these traits. From our sample of 3496 employees who attended the design thinking bootcamp, 2450 could be contacted after removing individuals with missing contact details. We sent the survey to attending public sector employees by email and mail three months after each five-day session, with additional field visits conducted to collect as many responses from employees as possible.

The survey consisted of several sections, starting with demographic questions about the employees, such as their gender, age, education, tenure, location, and rank; items related to the independent variables, *risk-taking propensity*, *emotional empathy*, and *cognitive empathy*; and several control variables for measuring potential alternative explanations. A Likert scale ranging from 1 to 5 (1 = strongly disagree to 5 = strongly agree) was used for most questions in the survey. Five items were reverse coded.

Following the initial survey, each respondent was asked to notify designated staff at the Prime Minister's Office via an online link once they had implemented their innovation, thus informing the dependent variable, *innovation implementation*. Independent verification of implementation outcomes was conducted by the monitoring team upon notification. To reduce response bias, if an employee had not notified the monitoring team about their implementation performance voluntarily within 12-months of bootcamp completion, the team contacted them to determine whether or not they had implemented a public sector innovation.

We received completed surveys from 440 public sector employees. Of these, 18 were dropped due to inconsistencies, leaving 422 for analysis. The response rate of 18 % is similar to that attained in other studies of public sector employees in Bangladesh (e.g., Jamil, 2002). This response rate must be understood in the context of response rates among bureaucrats in Bangladesh. Past research has argued that getting responses from bureaucrats in Bangladesh is a challenge. This challenge is demonstrated in comments from Jamil (2002, p.101) that 'in the Bangladeshi public sector context, surveys of bureaucrats are rare, and traditional questionnaire techniques frequently applied in the West do not fare as well.'

Furthermore, comparing the sample characteristics (n = 422) with those of the population (n = 2450) reveals that the sample is generally representative of the population with respect to gender, location and rank. Specifically, the percentage of male responses in the sample is similar to the percentage of males in the population (81 % and 82 %, respectively), and the percentage of female responses is also comparable to the percentage of females in the population (19 % and 18 %, respectively). The sample percentage of responses for each of the seven divisions is also similar to the population percentage for each division, with an average difference of only 2.3 %. For rank, we obtained population data on whether participants worked at the national level (e.g., ministry) or the field level (e.g., sub-district). In this regard, the sample is also consistent with the population (73 % and 77 %, respectively, for national level; and 27 % and 23 %, respectively, for field level).These findings suggest that the sample is likely to be a good representation of the population. Additionally, the sample appears to be reflective of the overall public sector workforce in Bangladesh in terms of gender, age, education, and tenure, as supported by available statistics and analogous extant research (e.g., UNDP, 2012; Jahanshahi and Bhattacharjee, 2020).

3.2. Variables

3.2.1. Dependent variable

Innovation implementation measures the probability of successful implementation of an innovation. The successful implementation of an innovation was judged on whether it was a documented change that resulted in a significant reduction in *time*, *cost*, and number of *visits* (TCV) experienced by citizens when accessing government services. Use of the term TCV as a proxy for public sector innovation that is citizen-centric is widespread among public sector employees in Bangladesh as it has been promoted by the central government and represents an important set of criteria with which employees must comply when exploring and implementing innovative ideas. Consistent with Bloch's (2011) definition of public sector innovation, these implemented innovations included documented changes to services, goods, processes, organizational methods, or forms of communication with users. Public sector employees initially self-reported whether they thought they had successfully implemented a public sector innovation or not. Each response was then objectively cross-checked by dedicated staff from the Prime Minister's Office. An innovation attempt was deemed successful by the monitoring team if (i) it could be classified as a public sector innovation (cf. Bloch, 2011, p. 14), (ii) it originated from, and its implementation was mainly driven by, the employee, (iii) implementation occurred within 12-months of bootcamp attendance, and (iv) there was sufficient evidence that the innovation resulted in a significant reduction in *time*, *cost*, and number of *visits* (TCV) for citizens. The Office's judgment was used as the final verdict on whether the public sector employee had successfully implemented their innovation or not. Following investigations into each positive response, 2.5 % of responses were rejected (97.5 % acceptance rate). In sum, the dependent variable takes a binary value for the two mutually exclusive outcomes: 1 if an innovation was successfully implemented, and 0 otherwise. For examples of successful innovation implementation, refer to the descriptions in Table 1. Table 2 provides the count of successful innovations.

3.2.2. Independent variables

To measure *risk-taking propensity*, we developed a three-item scale. As existing measures of risk-taking propensity have not been designed for public sector employees pursuing TCV innovations, similar to Baer et al. (2022), we used a three-item scale to develop a relevant measure for our study. Further, we avoided using risk-taking items from existing individual entrepreneurial orientation (IEO) scales because such measures do not capture one's *propensity* to take risks. Moreover, items on such scales were designed for the private sector, while debate on their applicability within public sector settings continues (see Diefenbach, 2011; Santos et al., 2020). The items in our scale are: "I take risks when pursuing TCV innovation opportunities"; "I have a desire to explore new TCV based innovation opportunities"; and "Failure can be a learning opportunity".

To measure *cognitive empathy* and *emotional empathy* we drew our items from widely tested measures used in past research (Bernstein and

[7] We refer here to various forms of 'trait empathy', relatively stable and enduring characteristics, not 'state empathy', which can be thought of as reactions to circumstances that may last from several minutes up to an entire day (Nezlek et al., 2007). While 'state empathy' can be manipulated in lab experiments over short time frames (e.g., Van Lange, 2008), even purposefully designed empathy training has not been shown to impact emotional or cognitive 'trait empathy' levels in randomized controlled trials on adults beyond a few months. For example, in their meta-analysis of 16 randomized control trials on the efficacy of empathy training, Teding van Berkhout and Malouff (2016) conclude that there is insufficient evidence to support the claim that the effects of empathy training endure long enough to make such training worthwhile.

Table 1
Summarized examples of successfully implemented innovations by bootcamp participants.

Example	Description
App for fish farmers	A senior sub-district fisheries officer saw how a lack of awareness and availability of accessible fishery information made it difficult for fish farmers to find solutions to issues like diseases, fish culture methods, and other problems relating to fish production. As part of the training, the field-level employee brainstormed and designed a mobile app as a solution to create an easily accessible centralized solution hub for fish-farmers. The Android app 'Fish Advice' has already been downloaded approximately 27,892 times according to *a2i* officials.
Simplified registration process for cooperatives	A sub-district cooperative officer experienced problems with the registration process for cooperatives as middlemen manipulated citizens for information and services that are actually free to the public. The field-level employee designed an online application to streamline the process. Following successful piloting, the process was replicated with financial support from the department in 7 sub-districts. Due to this intervention, the steps needed to receive the cooperative registration certificate dropped by 50 %, and required paperwork fell by over 75 %. According to *a2i*, the innovation has led to a 74 % reduction in time, 74 % reduction in cost, and 58 % reduction in visits.
VIP card for the rural poor	A public health manager in a local district council saw that rural citizens were not visiting sub-district health complexes to access basic health information and services due to their past interactions with public sector managers, whose domineering behavior made them feel nervous. The public health manager came up with the idea of designing and printing VIP cards to give to the rural poor. After mobilizing a small budget with support from his supervisor for the printing and distribution of these VIP cards, the number of rural poor who visited the health complex tripled from 12 to 40 per day.

Davis, 1982; McBane, 1995) and subjected our scale to thorough robustness checks (see Homburg et al., 2009; Wieseke et al., 2012). Exploratory factor analysis loads our empathy items on two dimensions of *cognitive empathy* and *emotional empathy*. Table 3 contains a complete list of measures and Table 4 displays the psychometric properties of our scales.

3.2.3. Control variables

We have included several control variables to account for organizational-level and individual-level effects. Previous research on entrepreneurship suggests that the size of the organization, work location, and types of agencies have a direct impact on innovation activity in an organization (Hornsby et al., 2009; Kearney et al., 2008). Individual-level controls, such as respondents' gender, job level, tenure, education, and the cohort in which the bureaucrat attended the training, can also have an effect on innovation outcomes (e.g., Demircioglu and Chowdhury, 2021). Baseline differences between the four cohorts were compared on key demographic variables using chi-square and *t*-test statistics. Table 2 shows the demographic characteristics of the research sample for each cohort. Cohorts did not differ significantly by age, gender, or education type, but did differ significantly by tenure, education level, location, and rank. Controlling for these variables in the analyses accounted for these differences. In addition, no significant differences were found between the participants in the four cohorts with regard to risk-taking propensity and emotional and cognitive empathy.

Based on previous research, this study also accounts for organizational-level and individual-level effects by using several control variables, namely *citizen relations*, *power and responsibility*, *organizational energy*, *resources*, and *external collaboration*. These controls were captured in the survey using scales drawn from the relevant literature. Since past research has highlighted the importance of engaging with citizens during the innovation process (Roper and Bourke, 2022), *citizen relations* were included in this study. The scales for *citizen relations* were drawn from Jamil (2002). Past research has also shown a positive correlation between power and responsibility of employees and innovation outcomes (Arundel et al., 2019), hence we included a measure of *power and responsibility* from Jamil (2002). *Energy* of leaders and *resources* have been shown to influence innovation (Storey et al., 2016; Arundel et al., 2019). These scales were drawn from Rao and Weintraub (2013). As collaboration with external firms has also been shown to drive innovation (Arundel et al., 2019), a scale for *external collaboration* was drawn from OECD (2017). The items of these scales are detailed in Table 3. The psychometric properties of these control variables are presented in Table 4.

3.3. Estimation

We analyze the data using univariate, bivariate, and multivariate analysis. This is followed by additional analysis, including robustness checks. In the univariate analysis we present descriptive statistics such as mean and standard deviation, and exploratory factor analysis; in the bivariate analysis we present the correlational matrix; and in the multivariate analysis we present results from a logit model along with visual evidence from quartile splits. We use a cross-sectional logit model because the dependent variable has a positive binary response of either 1 or 0, and the data collected are cross-sectional.

We also run additional analyses. First, we account for endogeneity that may occur due to potential omitted variables, measurement error or simultaneous causality by calculating a Gaussian copula for the independent variables. Second, we ascertain the predictive ability of our model by calculating the sensitivity and specificity of our preferred specification, including determining the predicted cut-off points that allow us to classify public sector employees as successful intrapreneurs on the basis of their psychometric scores.

4. Results

4.1. Univariate analysis

Table 2 presents a comprehensive overview of the sample characteristics for the public sector employees, including the number who successfully implemented their innovation, alongside their gender, age, tenure, education level, education type, geographic location, and level within the government hierarchy in which they worked. It also offers a comparison of these variables for each of the four cohorts.

Table 3 presents the descriptive statistics for the dependent variable, independent variables, and control variables. The dependent variable, *innovation implementation*, has a score of 1 for 250 bureaucrats, and thus has a mean score of 0.592. The three independent variables, *risk-taking propensity*, *emotional empathy*, and *cognitive empathy*, have mean scores of 4.477, 3.858, and 4.331 respectively. Among the control variables, *citizen relations*, *power and responsibility*, *energy*, *resources*, and *external collaboration* have mean scores of 3.735, 2.981, 4.139, 3.829, and 3.193 respectively. We validated our constructs by following the standard procedures suggested in the literature (Bagozzi and Yi, 1988; Blunch, 2013). Table 4 presents the composite reliability (CR) and the average variance extracted (AVE) for the independent and control variables. Our values of CR are modest. Some values of CR exceed the commonly recommended threshold of 0.70 (Fornell and Larcker, 1981), while others fall short of it. Thresholds for composite reliability are up for debate, with different authors offering different threshold suggestions (Aguirre-Urreta et al., 2019; Cronbach and Shavelson, 2004). Much depends upon how many items a scale has. Smaller numbers of scale items tend to result in lower levels, while larger numbers of scale items tend to

Table 2
Sample characteristics.

Variables	Total (422) (%)	Cohort1 (78)	Cohort2 (89)	Cohort3 (111)	Cohort4 (144)	χ^2	Sig
Gender						3.98	p > .05
Male	343 (81)	67	67	92	117		
Female	79 (19)	11	22	19	27		
Age						5.16	p > .05
25–31years	63 (15)	6	8	11	38		
32–41 years	180 (43)	38	33	46	63		
42–51 years	140 (33)	30	40	36	34		
52–59 years	39 (9)	4	8	18	9		
Tenure						26.41	p < .05
1 to 3 years	39 (9)	2	1	7	29		
4 to 9 years	132 (31)	21	29	33	49		
10 or more years	251 (60)	55	59	71	66		
Education level						10.70	p < .05
PhD	17 (4)	6	2	3	6		
Postgraduate	341 (81)	68	77	84	112		
Undergraduate	64 (15)	4	10	24	26		
Education type						0.99	p > .05
Social science	208 (49)	43	43	50	72		
Natural science	141 (34)	24	32	36	49		
Applied science	73 (17)	11	14	25	23		
Location						23.08	p < .05
Dhaka	165 (39)	23	20	45	77		
Mymensingh	11 (3)	0	0	0	11		
Barisal	28 (6)	7	9	4	8		
Khulna	52 (12)	9	18	4	21		
Chittagong	50 (12)	13	12	18	7		
Sylhet	45 (11)	2	18	22	3		
Rajshahi	71 (17)	24	12	18	17		
Rank						13.33	p < .05
Upazila (sub-district)	175 (42)	46	49	37	43		
Zila (district)	90 (20)	14	17	36	23		
Division	44 (10)	7	7	9	21		
City corporation	49 (12)	6	4	18	21		
Municipality	14 (3)	1	3	4	6		
Ministry	12 (3)	0	4	3	5		
Directorate	5 (2)	1	1	0	3		
Rural: Sub-district and district	33 (8)	3	4	4	22		
Innovation implementation						0.69	p > .05
Success	250 (59)	44	53	76	77		
Failure	172 (41)	34	36	35	67		

	Mean (422)	Mean (78)	Mean (89)	Mean (111)	Mean (144)	F	Sig
Risk-taking propensity	4.477	4.427	4.449	4.531	4.479	0.78	p > .05
Emotional empathy	3.858	3.893	3.959	3.859	3.775	1.13	p > .05
Cognitive empathy	4.331	4.410	4.281	4.405	4.262	2.41	p > .05
Citizen relations	3.585	3.705	3.635	3.468	3.579	1.09	p > .05
Power and responsibility	2.981	3.122	3.101	3.014	2.806	4.71	p < .05
Energy	4.139	4.051	4.197	4.189	4.111	0.76	p > .05
Resources	3.829	3.712	3.955	3.838	3.809	1.09	p > .05
External collaboration	3.193	3.353	3.253	3.099	3.142	1.18	p > .05

achieve higher levels (Aguirre-Urreta et al., 2019). Our values of AVE are all above the commonly recommended threshold of 0.50 (Fornell and Larcker, 1981).

4.2. Bivariate analysis

Table 5 presents the correlation matrix of variables. There is no indication of multi-collinearity among the independent and control variables. We further perform collinearity diagnostics by computing the variance inflation factors (VIFs) for all variables. The VIF values range from 1.11 to 4.25 with a mean VIF of 1.79. The lowest VIF is for the variable gender and the highest VIF is for the variable age between 32 and 41 years. The correlation matrix and the VIFs together indicate that multicollinearity is likely not present in our data.

4.3. Multivariate analysis

We present the hypotheses tests using both quartile (25th, 50th and 75th percentile) splits and results from the logit model. Although all the quartile splits provided consistent results, the 25th percentile split presented a more balanced representation of the data due to its distribution characteristics. As a result, we have presented the results from the 25th percentile split in Fig. 2a, b, and c. However, it is important to exercise caution when interpreting these figures alone, as they do not consider other factors that may influence outcomes. Additionally, these figures only classify individuals based on a quartile split without considering their exact trait levels (see Fitzsimons, 2008). In contrast, the logit model addresses these limitations.

The 25th percentile split in Fig. 2a provides visual evidence that public sector employees with *risk-taking propensity* above the 25th percentile are more likely to successfully implement innovation than those below the 25th percentile ($p < .001$), thereby indicating support for H1. The logit model results (Main Model) presented in Column 6 of Table 6 also show that *risk-taking propensity* increases the likelihood of implementing an innovation ($\beta = 1.327$, $p < .001$). Another way to interpret this result is from its marginal effects, which show that a unit

Table 3
Summary of variables.

Conceptual variable (1)	Survey statements and innovation implementation criteria (2)	Element score (SD) (3)	Component mean (SD) (4)
Dependent variable			
Innovation implementation[a]	After self-reporting ("I implemented a TCV innovation in my office"), an innovation attempt was deemed successful by the monitoring team if (1) it could be classified as a public sector innovation; (2) it originated from, and its implementation was mainly driven by the employee; (3) implementation occurred within 12-months of bootcamp attendance; and (4) there was sufficient evidence that the innovation resulted in a significant reduction in *time*, *cost* and number of *visits* (TCV) for citizens.	0.592 (0.492)	N/A
Independent variables			
Risk-taking propensity	Failure can be a learning opportunity	4.737 (0.538)	4.477 (0.503)
	I have a desire to explore new TCV based innovation opportunities	4.509 (0.712)	
	I take risks when pursuing TCV innovation opportunities	4.184 (0.877)	
Emotional empathy	Other people's misfortunes usually disturb me a great deal	4.019 (1.111)	3.858 (0.766)
	I have tender feelings for people less fortunate than me	4.400 (0.871)	
	I become nervous if others around me are nervous	3.154 (1.399)	
Cognitive empathy	I try to consider everybody's opinion before I make a decision	4.547 (0.669)	4.331 (0.531)
	When I'm upset at someone, I try to put myself in their shoes	3.893 (1.214)	
	I try to look at the two sides to every question	4.521 (0.695)	
Control variables			
Citizen relations	Citizens view us as an innovative organization	3.727 (1.076)	3.735 (0.934)
	Administrative duties are better performed if we are closer to citizens	3.742 (1.435)	
Power and responsibility	Employees are responsible for innovation in public service delivery	4.002 (1.121)	2.981 (0.732)
	Innovation implementation does not require approval of top officials	1.959 (1.075)	
Energy	Supervisors can use appropriate strategies to help us navigate around organizational obstacles	4.185 (0.877)	4.139 (0.749)
	Supervisors inspire us with a vision for experimenting with TCV based opportunities	4.092 (0.911)	
Resources	We can rapidly allocate resources to scale up innovations that show public value creation promise	3.791 (1.122)	3.829 (0.883)
	We are rewarded for successful implementation of innovations	3.867 (1.186)	
External collaboration	We rely very much on partnership with local NGOs	2.964 (1.258)	3.193 (1.016)
	We rely very much on partnership with private sector actors	3.422 (1.154)	

[a] Note: Each claim of innovation implementation was independently verified and documented by the Prime Minister's Office to increase validity and address method bias. 97.5 % of respondent claims of implementation were successfully verified.

Table 4
Psychometric properties of measures.

Variables	M	SD	CR	AVE
Risk-taking propensity	4.477	0.503	0.544	0.762
Emotional empathy	3.858	0.766	0.643	0.719
Cognitive empathy	4.331	0.531	0.467	0.678
Citizen relations	3.735	0.934	0.524	0.689
Power and responsibility	2.981	0.732	0.543	0.701
Energy	4.139	0.749	0.704	0.817
Resources	3.829	0.883	0.583	0.729
External collaboration	3.193	1.016	0.711	0.814

increase in the *risk-taking propensity* score will result in a 0.236 unit increase in the innovation implementation variable.

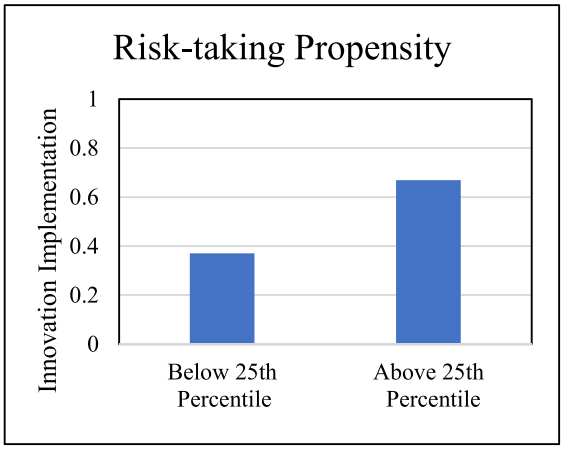
The visual depiction in Fig. 2b shows that emotional empathy values lower than the 25th percentile correspond to significantly ($p < .01$) higher innovation implementation scores among public sector employees relative to emotional empathy values above the 25th percentile. Thus, Fig. 2b indicates support for H2. Furthermore, the results of the logit model presented on Column 6 of Table 6, show strong empirical support for H2. Thus, we find that *emotional empathy* decreases the likelihood of implementing innovation ($\beta = -0.734$, $p < .001$), indicating that employees with higher emotional empathy are less likely to implement their innovations. The marginal effects from these results show that a unit increase in the *emotional empathy* score will result in a 0.130 unit decrease in the innovation implementation variable.

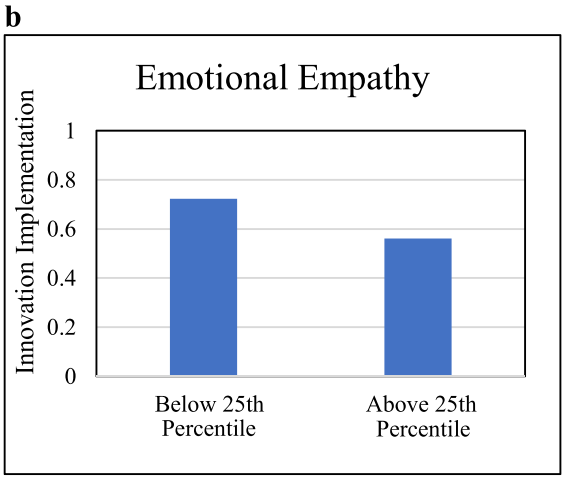
Fig. 2c presents the 25th percentile split of the data, providing visual evidence that public sector employees with *cognitive empathy* above the 25th percentile are more likely to implement an innovation compared to those below the 25th percentile ($p < .001$). Fig. 2c thus indicates support for H3. The logit model results presented in Column 6 of Table 6 show that the coefficient of *cognitive empathy* is positive and significant ($\beta = 0.993$, $p < .001$), thus showing support for H3. We conclude from this that *cognitive empathy* can help public sector employees implement their citizen-centric innovations. The marginal effects from these results show that a unit increase in the *cognitive empathy* score will result in a 0.176

Table 5
Correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Innovation implementation	1.00								
(2) Risk-taking propensity	0.327*	1.00							
(3) Emotional empathy	−0.085	0.141*	1.00						
(4) Cognitive empathy	0.248*	0.378*	0.296*	1.00					
(5) Citizen relations	0.182*	0.343*	0.035	0.154*	1.00				
(6) Power and responsibility	0.097*	−0.003	0.007	0.080	0.061	1.00			
(7) Energy	0.157*	0.437*	0.164*	0.227*	0.160*	0.005	1.00		
(8) Resources	0.168*	0.278*	0.102*	0.187*	0.130*	0.080	0.440*	1.00	
(9) External collaboration	0.094	0.169*	0.055	0.142*	0.054	0.042	0.178*	0.316*	1.00
Mean	0.592	4.477	3.858	4.331	3.735	2.981	4.139	3.829	3.193
SD	0.492	0.503	0.766	0.531	0.0.934	0.732	0.749	0.883	1.016

* $p < .05$. In interest of space all the other controls have not been included here.





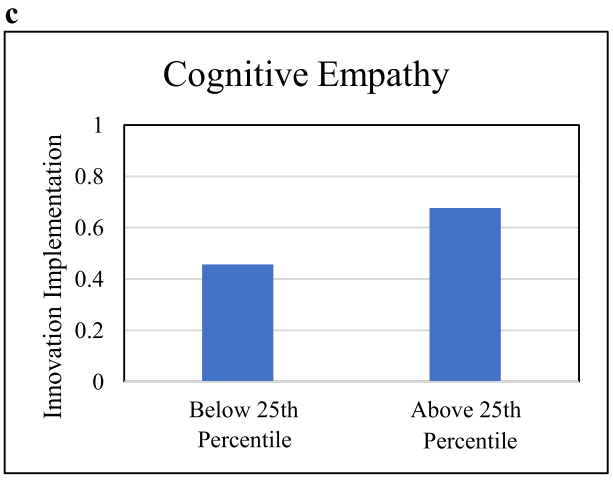


Fig. 2. a. 25th percentile split for *risk-taking propensity*.
b. 25th percentile split for *emotional empathy*.
c. 25th percentile split for *cognitive empathy*.

unit increase in the innovation implementation variable.

Our three hypothesized variables have substantial explanatory power. In Table 6, model 2 with only controls shows a McFadden's R^2 value of 0.126, which significantly improves to 0.217 in model 6 (Freese and Long, 2006), indicating a 72 % increase in the proportion of variance explained. This result highlights the considerable explanatory power of our hypothesized variables (Freese and Long, 2006).

4.4. Additional analysis

To deal with endogeneity that may occur due to a potential omitted variable that simultaneously drives both independent and dependent variables in our model, we calculate a Gaussian copula (*Copula*) for the independent variables and plug it into the logit model (Park and Gupta, 2012). The results in Column 7 of Table 6 show that our results are similar after accounting for endogeneity in the logit model. For all the results of Table 6, the CE variable has been winsorized at the 95th percentile (Anderson et al., 2018).

Next, we ascertain the predictive ability of our model and aim to classify the public sector employees on the predictive ability of our model. In doing so, we first classify the predictive ability of the model into four categories:

True positives: When the Prime Minister's Office records an employee as successful in the dependent variable (*innovation implementation* = 1) and our model also predicts them as successful (*innovation implementation* = 1).
True negatives: When the Prime Minister's Office records an employee as unsuccessful in the dependent variable (*innovation implementation* = 0) and our model also predicts them as unsuccessful (*innovation implementation* = 0).
False positives: When the Prime Minister's Office records an employee as unsuccessful in the dependent variable (*innovation implementation* = 0) but our model predicts them as successful (*innovation implementation* = 1).
False negatives: When the Prime Minister's Office records an employee as successful in the dependent variable (*innovation implementation* = 1) but our model predicts them as unsuccessful (*innovation implementation* = 0).

Based on the above categorizations, we calculate the sensitivity, specificity, and accuracy of our model. The sensitivity of the model is its ability to correctly identify successful employees when they indeed implemented their innovations. Sensitivity is calculated as: Number of true positives/(Number of true positives + Number of false negatives). The specificity of the model is its ability to correctly identify unsuccessful employees when they indeed did not implement their innovations. Specificity is calculated as: Number of true negatives/(Number of true negatives + Number of false positives). The accuracy of the model is its ability to correctly identify successful and unsuccessful employees over the total number of employees. Accuracy is calculated as: (Number of true positives + Number of true negatives)/(Total number).

Fig. 3 plots sensitivity as the vertical (Y) axis and (1-specificity) as the horizontal (X) axis. The plot in Fig. 3 shows the receiver operating characteristic (ROC) curve. The area under the curve (AUC) distinguishes between true positives and true negatives and summarizes the discrimination ability of a model. The greater the AUC, the better the model at predicting success and failure. While an AUC of 0.5 suggests that the model is unable to discriminate between success and failure, as shown in Fig. 3 our model has an approximated AUC value of 0.800, suggesting that its ability to discriminate between successful innovations and non-successful innovations is excellent (Mandredkar, 2010).

Since our model is able to discriminate between successful versus unsuccessful innovation implementation, we can determine the probability cut-off point that will allow us to classify the public sector employees on the basis of psychometric scores. To do so, in Fig. 4 we plot both sensitivity and specificity versus the probability cut-off for the present model. This shows that the cutoff point is close to 0.6. This probability cutoff of 0.6 is used to develop the classifications in Table 7, and cases with probabilities $\geq$ 0.60 are provided to characterize the

Table 6
Logit model results.

Variables (1)	Controls (2)	Risk-taking propensity & controls (3)	Emotional empathy & controls (4)	Cognitive empathy & controls (5)	Main Model (6)	Model with Gaussian copula (7)
Risk-taking propensity (H1)		1.444*** (0.288)			1.327*** (0.299)	1.636* (0.736)
Emotional empathy (H2)			−0.436** (0.155)		−0.734*** (0.174)	−1.674* (0.720)
Cognitive empathy (H3)				0.882*** (0.236)	0.993*** (0.261)	2.237* (1.125)
Gender	−0.143 (0.312)	−0.097 (0.314)	−0.169 (0.328)	−0.015 (0.318)	−0.012 (0.342)	−0.012 (0.339)
Dhaka	−0.489 (0.355)	−0.480 (0.369)	−0.590 (0.358)	−0.478 (0.371)	−0.626 (0.387)	−0.594 (0.387)
Barisal	−1.073 (0.843)	−1.347 (0.889)	−1.076 (0.867)	−1.324 (0.859)	−1.605 (0.938)	−1.617 (0.932)
Khulna	−0.633 (0.515)	−0.757 (0.531)	−0.664 (0.516)	−0.486 (0.524)	−0.599 (0.528)	−0.495 (0.535)
Chittagong	−0.553 (0.468)	0.664 (0.476)	0.475 (0.474)	0.527 (0.487)	0.543 (0.497)	0.655 (0.522)
Sylhet	−0.259 (0.425)	−0.237 (0.443)	−0.319 (0.434)	−0.268 (0.447)	−0.306 (0.489)	−0.252 (0.491)
Rajshahi	−0.269 (0.455)	−0.207 (0.467)	−260 (0.457)	−0.159 (0.476)	−0.079 (0.481)	−0.024 (0.488)
25–31 years	−0.920 (0.556)	−0.833 (0.568)	−0.976 (0.563)	−0.860 (0.549)	−0.890 (0.572)	−0.838 (0.568)
32–41 years	−0.431 (0.460)	−0.239 (0.464)	−0.437 (0.455)	−0.374 (0.449)	−0.230 (0.448)	−0.208 (0.446)
42–51 years	−0.577 (0.419)	−0.359 (0.429)	−0.549 (0.413)	−0.579 (0.412)	−0.355 (0.411)	−0.338 (0.406)
Doctorate	1.146 (0.613)	1.414* (0.613)	1.086 (0.633)	1.043 (0.609)	1.178 (0.632)	1.254* (0.628)
Postgraduate	0.784 (0.342)	0.847* (0.353)	0.801* (0.347)	0.794* (0.345)	0.889 (0.368)	0.920* (0.367)
Social science	0.393 (0.315)	0.121 (0.327)	0.376 (0.322)	0.411 (0.313)	0.122 (0.345)	0.123 (0.344)
Natural science	0.382 (0.327)	0.214 (0.338)	0.263 (0.336)	0.461 (0.331)	0.115 (0.367)	0.099 (0.368)
1 to 3 years	−0.151 (0.542)	−0.201 (0.545)	−0.278 (0.565)	−0.186 (0.531)	−0.446 (0.566)	−0.488 (0.576)
4 to 9 years	−0.457 (0.311)	−0.303 (0.331)	−0.517 (0.311)	−0.439 (0.319)	−0.395 (0.335)	−0.397 (0.339)
Citizen relations	0.374** (0.122)	0.198 (0.133)	0.383** (0.125)	0.334** (0.126)	0.155 (0.138)	0.157 (0.137)
Power and responsibility	0.176 (0.162)	0.236 (0.182)	0.163 (0.162)	0.157 (0.170)	0.179 (0.179)	0.188 (0.179)
Energy	0.182 (0.164)	−0.165 (0.195)	0.239 (0.166)	0.072 (0.173)	−0.159 (0.202)	−0.159 (0.201)
Resources	0.219 (0.152)	0.148 (0.155)	0.233 (0.152)	0.198 (0.159)	0.163 (0.170)	0.186 (0.173)
External collaboration	0.077 (0.117)	−0.044 (0.122)	0.082 (0.119)	0.035 (0.123)	−0.019 (0.130)	−0.021 (0.132)
Upazila (sub-district)	−0.313 (1.008)	−0.224 (0.990)	−0.456 (1.025)	−0.398 (0.970)	−0.570 (0.968)	−0.537 (0.974)
Zila (district)	0.628 (0.874)	0.415 (0.848)	0.645 (0.865)	0.269 (0.807)	0.043 (0.764)	0.018 (0.786)
Division	1.172 (0.884)	1.297 (0.888)	1.098 (0.875)	1.134 (0.807)	1.096 (0.773)	1.028 (0.793)
City corporation	−0.091 (1.115)	−0.607 (1.080)	−0.055 (1.118)	−0.725 (1.061)	−1.202 (1.084)	−1.125 (1.077)
Municipality	1.049 (0.911)	0.892 (0.892)	1.056 (0.910)	0.867 (0.822)	0.680 (0.807)	0.625 (0.828)
Ministry	1.211 (0.849)	1.189 (0.828)	1.135 (0.843)	0.992 (0.776)	0.805 (0.741)	0.705 (0.761)
Directorate	0.752 (0.855)	0.681 (0.828)	0.697 (0.849)	0.561 (0.771)	0.349 (0.739)	0.229 (0.757)
Cohort1	−0.467 (0.358)	−0.450 (0.389)	−0.200 (0.359)	−0.604 (0.371)	−0.603 (0.402)	−0.619 (0.396)
Cohort2	−0.231 (0.351)	−0.197 (0.362)	−0.095 (0.357)	−0.222 (0.360)	−0.117 (0.386)	−0.129 (0.394)
Cohort3	0.643 (0.322)	0.582 (0.336)	0.646* (0.326)	0.508 (0.323)	0.448 (0.350)	0.457 (0.349)
Copula risk-taking propensity						−0.557 (1.222)
Copula emotional empathy						2.491 (1.874)
Copula cognitive empathy						−2.377 (2.127)
Intercept	−4.186*** (1.415)	−8.310*** (1.555)	−2.601 (1.508)	−7.043*** (1.603)	−8.441*** (1.689)	−11.475* (4.871)
Observations	422	422	422	422	422	422
Loglikelihood (chi-square)	−249.179*** (0.000)	−235.644*** (0.000)	−0.245.256*** (0.000)	−241.997*** (0.000)	−223.425*** (0.000)	−221.969*** (0.000)
McFadden's R^2	0.126	0.174	0.140	0.152	0.217	0.222

Standard errors in parentheses.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

three key traits—*risk-taking propensity*, *cognitive empathy*, and *emotional empathy*—by their effect on *innovation implementation*. Table 7 shows that 173 respondents were predicted correctly as true positives. These public sector employees display the three key traits of *risk-taking propensity* (high), *emotional empathy* (low), and *cognitive empathy* (high), and they are successful at *innovation implementation*. We label these public sector employees *implementors*. However, 128 respondents were predicted as true negatives. We label these public sector employees *ill-equipped*, as they resist innovation agendas, have none of the three key traits, and are not successful at *innovation implementation*. Furthermore, a total of 77 respondents are false negatives and 44 are false positives. We label the 77 public sector employees *serendipitous* as they do not exhibit the three key traits but are successful at *innovation implementation*. We label the 44 public sector employees *lackadaisical* as they have the three key traits but are not successful at *innovation implementation*. The sensitivity, specificity, and accuracy of our model are 69.200 %; 74.418 %, and 71.327 %, respectively.

5. Discussion and conclusions

This article is (to our knowledge) the first to investigate the impact of individual-level public sector employee traits—in this case, risk-taking propensity and emotional and cognitive empathy—on individual innovativeness following a design thinking intervention in a developing country setting. We found that risk-taking propensity was positively related to innovation implementation likelihood. In addition, far from being beneficial across the entire innovation process, we found that different forms of empathy have divergent effects: emotional empathy was negatively associated, and cognitive empathy positively associated, with innovation implementation. Accordingly, this is the first article to

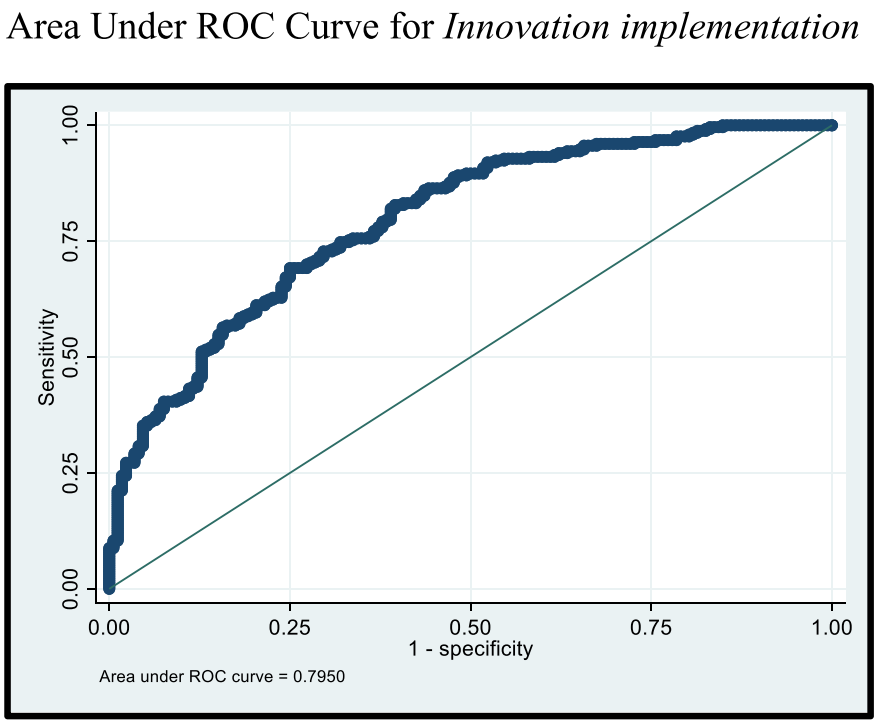


Fig. 3. Area under ROC curve for *innovation implementation*.

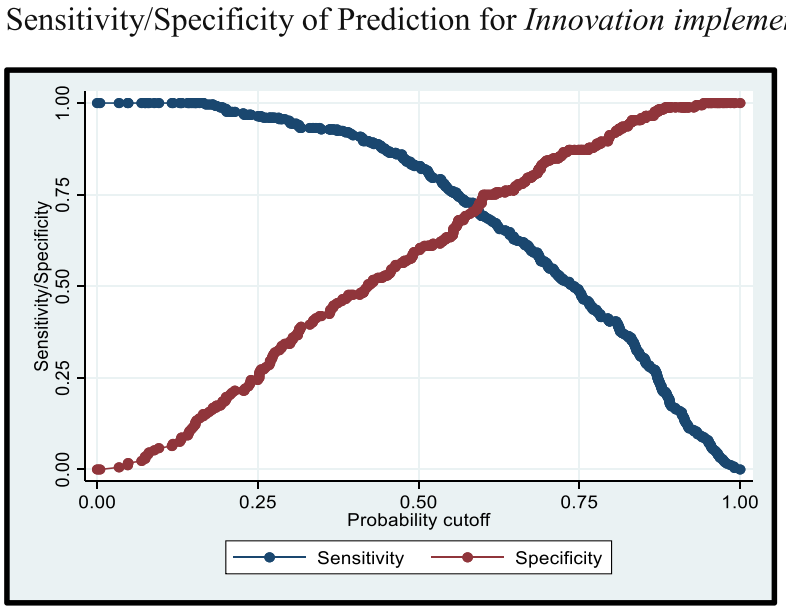


Fig. 4. Sensitivity/specificity of prediction for *innovation implementation*.

test and find evidence for the 'empathy divergence thesis' within the field of public sector innovativeness, and more broadly, within entrepreneurship, creativity, and innovation studies.

By investigating the role of individual-level traits on individual-level innovation outcomes, we contribute to public sector innovativeness literature that calls for more granular levels of analysis for why some employees are more innovative than others (e.g., Demircioglu, 2020). In addition, we contribute to at least three related literature streams. First, despite the largely taken-for-granted assumption that empathy is central to innovation performance—especially among proponents of design thinking (Clarke and Craft, 2019)—we find that, among those having undertaken design thinking training, the relative effect of risk-taking propensity on implementation was greater. This suggests that important design thinking traits besides empathy should receive more attention from human-centered innovation scholars and practitioners (see Micheli et al., 2019). Furthermore, by empirically revealing emotional empathy as an inhibitor of innovation implementation, our findings lend empirical support to anecdotal reports from practitioners on the downsides of high empathy on innovativeness when applying design thinking approaches (e.g., Stanford D. School, 2017).

Second, our findings contribute to the entrepreneurship literature, particularly in relation to simulated empathy theory, which places empathy at the "very heart" of entrepreneurship (Packard and Burnham, 2021, p. 8). We both extend this theory and reveal potential boundary

Table 7
Observed and predicted frequencies for *innovation implementation* (with cutoff of 0.6).

Observed	Above cutoff	Below cutoff	Total
Successful *innovation implementation*	173 Implementors (True positives)	77 Serendipitous (False negatives)	250
Unsuccessful *innovation implementation*	44 Lackadaisical (False positives)	128 Ill-equipped (True negatives)	172
Total	217	205	422

Note: Sensitivity = 173 / (173 + 77) % = 69.200 %. Specificity = 128 / (128 + 44) % = 74.418 % Accuracy = (173 + 128) / 422 % = 71.327 %.

constraints. Notably, our findings substantiate the view that emotional empathy is less useful than cognitive empathy, yet, by showing that emotional empathy can be detrimental to entrepreneurial efforts, especially implementation efforts, we highlight a potential boundary condition. Packard and Burnham's (2021, p. 3) "spectrum of vicarious imaginations" places each form of empathy along a unidimensional spectrum (weak-to-strong) whereby stronger forms are depicted as more useful than weaker forms. Our findings imply that an additional dimension (negative-to-positive) could be added.

Third, we contribute to the literature on the 'empathy divergence thesis' and the "urgent need" to explore this thesis across different forms of empathy and their outcomes in different contexts (Weisz and Cikara, 2021, p. 213). We extend this 'turn' in theorizing about empathy to innovation performance, taking it beyond narrow settings that include competitive tasks in laboratory settings (e.g., Galinsky et al., 2008; Gilin et al., 2013). Our study is the first to apply this thesis to innovation and entrepreneurship outcomes, let alone to an applied public sector developing country context. Moreover, in accordance with recent neuroscience findings, our results indicate that empathy should never be measured as a single item within entrepreneurship, creativity, and innovation studies.

Our study provides insights to managers about which public sector employees are likely to become innovators, and which may be the most promising candidates for design thinking training. Our findings show that those who fit a particular profile——higher in risk-taking propensity and cognitive empathy, but lower in emotional empathy—are most likely to turn their ideas into reality. We theorize that, with these traits, employees are better able to overcome barriers to implementation by appropriately engaging in 'framing' and 'fixing' activities. Accordingly, if managers want to increase the innovativeness of employees, their workgroups, and ultimately their organizations, they could select these individuals to champion innovation efforts or find systematic ways of rewarding their pro-innovation behaviors. Furthermore, adopting the short scales used in this study to help select candidates for design thinking training may prove particularly useful in many developing country contexts where the cost of training can be prohibitive (see Quinn and Woodruff, 2019). The widespread use of these scales as selection tools may enhance the quality of their innovation training programs in a cost-effective manner.

Finally, our study is subject to certain limitations that offer promising future research directions. First, while we focus on a single, developing market context to increase internal validity and shed light on developing country contexts (see Vassallo et al., 2019; Freeman, 2001), future research should test the generalizability of our findings by studying public sector employees in other national and organizational contexts. Equally, while we use survey-based methods to test our hypotheses, future research might combine our methods with others including laboratory and field experiments, to further identify and test the underlying causal mechanisms. Second, mindful of the resource limits of our government partners, we focused on risk-taking propensity and empathy because of their centrality within innovation and entrepreneurship theory and their lack of investigation within the public sector, especially on their overall effect on innovation implementation likelihood. Informed by our findings, future studies could measure other traits including the 'Big Five' personality traits (e.g., Stock et al., 2016) alongside risk-taking propensity and cognitive and emotional empathy and compare these to simply relying on information held in resume profiles when hiring potential intrapreneurs. Third, we are aware of no evidence that design thinking training can significantly alter the risk-taking propensity, emotional or cognitive empathy of participants, especially over the long term. However, despite being relatively fixed traits, given that we were only able to measures participants' traits after attending the design thinking bootcamp, we cannot rule out reverse causality. Even though most survey-based studies on public sector innovativeness also cannot rule this out, future studies should further validate the causal nature of the relationships uncovered. Fourth, as with previous studies on innovation implementation (e.g., Baer, 2012; Stock et al., 2016), we assume a person-centric perspective on entrepreneurial innovation. In large part, this is an antidote to the majority of empirical studies on public sector innovation that focus on organizational- or team-level factors. While we control for several of these broader influences, future studies could analyze individual factors in relation to organization- or team-level factors, including their interactions (e.g., Ter Wal et al., 2017; Ebersberger et al., 2021), for a more granular understanding of the innovativeness of public sector employees. Such research may further reveal the role of each type of empathy as both an 'enabler' and 'disabler' depending on the particular innovation outcome (e.g., implementation frequency versus quality) and context (e.g., risk-averse versus risk-tolerant organizational culture).

In conclusion, this study highlights the importance of individual traits in public sector innovation implementation. By revealing that risk-taking propensity and cognitive empathy positively influence innovation implementation, while emotional empathy has a negative effect, these results have important implications for public sector innovation processes. Accordingly, we hope that this study inspires further research into individual-level public sector innovation performance.

CRediT authorship contribution statement

Jarrod P. Vassallo: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Sourindra Banerjee:** Conceptualization, Software, Formal analysis, Data curation, Writing – original draft, Writing – review & editing. **Hasanuzzaman Zaman:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing. **Jaideep C. Prabhu:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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