Capturing innovation orientation in knowledge workers: development and validation of a measurement scale

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Erratum: It has come to the attention of the publisher that the Thomas, A., Khatri, P., Dabas, V. and Coniglio, I.M. (2024), "Capturing innovation orientation in knowledge workers: development and validation of a measurement scale", *Journal of Knowledge Management*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JKM-12-2023-1276, contained the incorrect affiliation for Vidushi Dabas. This error was introduced during the production process. Department of Mechanical, Energy and Management Engineering, University of Calabria, Rende, Italy has been corrected to University School of Management Studies, Guru Gobind Singh Indraprastha University, New Delhi, India. The publisher sincerely apologises for this error and for any confusion caused.

Abstract

Purpose – *Competition in the modern, knowledge-based economy is utterly pendant on innovation, rendering it indispensable in virtually every organisation. Knowledge workers, therefore, must remain vigilant, spanning novel ways to innovate. Given the relevance of innovation orientation (IO) in knowledge work, it is imperative to possess an extensive understanding of the concept. Therefore, this study aims to develop and validate a measurement scale to gauge employees' IO.*

Design/methodology/approach – *Considering that the instruments now in existence exhibit insufficiency for measuring knowledge workers' IO in its entirety, the mixed-method approach used in this study draws on both qualitative and quantitative findings across various studies, to address this problem. This study has been organised into five stages: item generation, scale purification, scale refinement, nomological validation and generalizability.*

Findings – *This study establishes and verifies a second-order, reflective–reflective IO measure founded on multiple samples, encompassing the dimensions of creative orientation, learning orientation, first-mover orientation, trust orientation and agility orientation. The resultant IO scale serves as a robust and reliable tool that is capable of being leveraged to explain, assess and enhance IO for knowledge workers.*

Research limitations/implications – *The rigorous methodology used in this scale development procedure serves as a benchmark for prospective scale development methodologists. From a managerial stance, this study serves managers/leaders concerning how to foster an innovation-oriented work environment to uncover employees' hidden innovators. Organisations can leverage this study to discover, cultivate and capitalise on knowledge workers' IO.*

Originality/value – *Although there exists an abundance of research on IO viewed from an institutional standpoint, research centred on the IO of knowledge workers is scarce. To bridge this gap, this study has developed and validated a scale for measuring knowledge workers' IO.*

Keywords *Innovation orientation, Innovativeness, Knowledge workers, Scale development, Scale validation, Content validity index, Hierarchical component modelling, Mixed-method*

Paper type *Research paper*

1. Introduction

Innovation transcends above creation, prioritising betterment, which is indispensable for strides forward (Bamel *et al.*, 2022). Precisely, the success of organisations in the contemporary competitive context is growing increasingly dependent on the ability of individuals to generate and absorb knowledge (Ul-Durar *et al.*, 2023). Frontline innovators or knowledge workers are now an abundantly prized resource to organisations across the globe. These innovators are indispensable for organisations due to their ability to foster innovation. Nevertheless, permitting knowledge workers continuing to be lucrative might be an unending endeavour. These competent employees have a tendency to become mired in mundane work, which leaves them with little time for innovative thinking. The majority of organisations at present acknowledge the upsides of tapping knowledge workers'

innovative tendencies (Education, 2023). The so-called knowledge workers have a key role in any type of organisation, as they are the people who allow the organisation itself to learn and improve (Distel, 2019; Hannola *et al.*, 2018). In particular, in contexts in which competition requires the generation of new products or new processes, or even in contexts in which it is necessary to adapt to external changes, it is important that knowledge workers are equipped with creativity, learning and problem-solving ability (Sjödin *et al.*, 2019; Shujahat *et al.*, 2019). In essence, the presence of knowledge workers with a substantial orientation towards innovation is necessary; yet, doing so successfully frequently presents obstacles (Yildiz *et al.*, 2021).

The sociologist Gabriel Tarde first mapped out the premise of innovation, drawing from the belief that individuals use novel devices and behavioural tendencies to bring about radical shifts in society (Kochetkov, 2023). The literature on innovation has progressed extensively since then, with the latest buzz being innovation orientation (IO) (Tian *et al.*, 2023). IO is an indispensable skill for knowledge workers, implying optimal use of knowledge, embracing cutting-edge technology, undertaking risks and being imaginative and ambitious (Adriano and Callaghan, 2022; Atasoy *et al.*, 2023). Innovative knowledge workers are avid claimants of new knowledge (Borodako *et al.*, 2023; Açikgöz *et al.*, 2023). They are able to endure ambiguity, and are likely to show favourable acceptance intentions (Lu *et al.*, 2005; Schierjott *et al.*, 2018). Employees with a fervent IO nurture original concepts and novel procedures that stray from standard patterns (Adriano and Callaghan, 2022; Abhari *et al.*, 2022). Such innovatively-oriented individuals exhibit a penchant to depart from established standards, are driven to find novel solutions to challenges and are more probable to adapt to innovations (Adriano and Callaghan, 2022). Moreover, they offer fresh perspectives on problems and tasks (Schierjott *et al.*, 2018). IO is of the utmost importance for academics engaged with the forthcoming spate of innovations. However, IO may pose a hurdle to managers in terms of eliciting loyalty from employees who do not readily adapt to corporate conventions and procedures (Perry *et al.*, 2016; Abhari *et al.*, 2022). This research, therefore, has the capability to significantly influence innovation management by providing an understanding of motivating, retaining and effectively managing a unique workforce that is crucial to maintaining successful economies.

Studying innovation is by its very nature a multidisciplinary field (Kochetkov, 2023). Even though innovation is an indispensable phenomenon that is assessed at numerous levels (individual, group and organisational) (Martínez *et al.*, 2022; Borodako *et al.*, 2023), and in an field (Ali, 2019), yet, there fails to be ample research in the literature, concerning knowledge workers' IO (Nambisan, 2002; Ali, 2019). A number of studies have empirically examined IO from an individual standpoint (Nambisan, 2002; Siguaw *et al.*, 2006; Perry *et al.*, 2016; Ritala *et al.*, 2021) however, the majority of these studies have used either obsolete measures that lack generalizability, unidimensional scales or scales where IO is not a the primary construct under study (refer Table 2). This article focuses on individual IO as opposed to firm level IO, as the latter has been the primary focus of a substantial portion of innovation research (Hendarman and Cantner, 2017). IO is a relevant concept also when it comes to devising strategies to win over people who do not readily adapt to organisational change (Perry *et al.*, 2016; Ali, 2019; Martínez *et al.*, 2022). A key deficiency in the present research on IO is the lack of reliable and validated scales for individual IO primarily due to excessive emphasis on innovation being an output as opposed to being an employee behaviour (Nambisan, 2002; Martínez *et al.*, 2022). With the intent to cater for this research gap, present work proposes a scale to quantify IO with specific reference to knowledge workers.

At the outset, through the lens of conceptual development, this study radically alters the notion of IO by offering an alternative viewpoint. This comes about by developing a robust, second-order reflective–reflective IO scale, which competently plugs a gap in the innovation literature. In addition, this study is founded on robust methodologies and, hence, presents a noteworthy methodological contribution. The present research offers insight and profundity by fusing the precision of scientific approaches with knowledge from the social sciences. We delved into the

IO dimensions for knowledge workers in India, Poland and Italy. We used a mixed-method technique that integrates qualitative and quantitative observations. We constructed an accurate, reliable, five-dimensional IO scale by undertaking a set of five investigations with a sample of 671 innovation managers. We capitalise on the use of avant-garde instruments, especially the item-wise and scale-level content validity indexes (ICVI and SCVI), to guarantee that our evaluations are reliable, verifiable and generalizable (Finn and Kayandé, 2005; Rossiter, 2002). Such methods, which originate in dialecticism, give constructs an assertive abstraction, bolstering and stimulating further research (Churchill, 1979; Netemeyer *et al.*, 2003). Finally, the study addresses key practical implications for fostering IO, which is an indispensable endeavour for every organisation's prosperity. The remnant of the article is structured as follows: The literature review of IO is brought out in Section 2, accompanied by its theoretical foundation, antecedents–decisions–outcomes (ADO) structure and existing measures related to IO. The study's underlying methodology is explained in Section 3, and the full-scale development process for the IO measure developed in this study is detailed in Section 4. Section 5 showcases the discussions and implications for diverse stakeholders. Finally, Section 6 concludes the study whilst stressing its limitations and future research objectives.

2. Conceptual background

IO, in its core, is defined as an individual's desire for innovation and can be characterised as a person's zeal for innovation (Lee *et al.*, 2011). The innovation diffusion theory is a key source for literature on IO (Xerri, 2012; Hendarman and Cantner, 2017; Jeon *et al.*, 2020). For the comprehension of outperforming knowledge workers, where they ideally adapt, and in what manner their allegiance is fostered, IO is a paragon way to commence. Employees that show high levels of IO invariably outdo their peers and tend to be prized by their superiors (Perry *et al.*, 2016; Hendarman and Cantner, 2017). Not many studies perceive IO as a distinct construct. Verily, majority of research do not give an explicit explanation for IO. Consequently, there are often ambiguous and conflicting definitions and conceptualisations of IO. Several studies acknowledge the need for a standard measure of IO (Nambisan, 2002; Siguaw *et al.*, 2006; Ritala *et al.*, 2021). Often gauged as a personality trait, IO is a persistent propensity to conduct oneself continually in specific manners, which contributes to various facets of one's professional life, attitudes and behaviours (Perry *et al.*, 2016; Jeon *et al.*, 2020). Innovatively driven firms have to source employees who mirror their aspirations in terms of IO, assuming that congruence between employee and company requirements could result in job satisfaction (Lee *et al.*, 2011; Jeon *et al.*, 2020). Although there exist several measures for innovativeness of individuals, such as individual innovativeness scale by Hurt *et al.* (1977) and Llopis and D'Este (2022), or Robinson *et al.*'s (1991) Entrepreneurial Attitude Orientation Scale, still, scales gauging an individual's, especially knowledge worker's desire and zeal for innovation in terms of their creativity, learning, first-mover, trust and agility orientation still lack in literature. Sub-section 2.5 offers an extensive overview of the current measures of IO. For enhanced readability, a tabular summary is additionally provided (refer Table 2). Accordingly, insight into IO is a must for grasping the multitude of ways by which IO could facilitate knowledge workers within an organisational setting attain corporate objectives. Although there exists an abundance of research on IO viewed from an institutional standpoint, research cantered on the IO of individual employees are a rarity. To bridge this gap, we go into depth on IO's theoretical foundation, definitions, dimensions, antecedents and outcomes. Figure 1 portrays the dimensionality of IO whereas, Table 1 displays an outline of the literature-identified ADO of IO.

2.1 Theoretical background

The innovation diffusion theory is a major source of inspiration for the literature on IO (Hendarman and Cantner, 2017; Jeon *et al.*, 2020). The innovation diffusion theory (Rogers, 2003) contends that individual's innovativeness, a proclivity to embrace innovation, determines how they respond

Figure 1 Dimensionality of IO

Author→ Dimension↓	(Ali, 2018)	(Yi et al., 2006)	(Sarıköse & Türkmen, 2020)	(Hendarman & Cantner, 2017)	(Llopis & D'Este, 2022)	(Perry et al., 2016)	(Schierjott et al., 2018)	(Lu et al., 2005)	(Xerri, 2012)	(Kruft et al., 2019)	(Watson et al., 2011)	(Theodosiou et al., 2012)	(Reinhardt & Enke, 2020)
Novelty						✓	✓			✓	✓	✓	✓
Openness to new ideas		✓	✓	✓			✓	✓				✓	
Adoption of innovation						✓	✓			✓		✓	✓
Early Adaptation	✓		✓	✓			✓					✓	
Personal Innovativeness		✓						✓					
Ambiguity						✓	✓						
Creating new things				✓	✓		✓	✓		✓	✓	✓	

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Table 1 Summary of the ADO framework

Antecedents of IO	*Decisions (dimensions) of IO*	*Outcomes of IO*
Passion (Hendarman and Cantner, 2017; Ye *et al.*, 2021; Hölzle, 2022)	*Novelty* (Bouncken and Koch, 2007; Watson *et al.*, 2011; Perry et al, 2016; Schierjott *et al.*, 2018; Kruft *et al.*, 2019; Reinhardt and Enke, 2020)	*Sense of accomplishment* (Ali, 2019; Seifert *et al.*, 2022; Talwar *et al.*, 2022).
Optimism (Le and Jian, 2011; Hendarman and Cantner, 2017)	*Openness to new ideas* (Yi *et al.*, 2006; Theodosiou *et al.*, 2012; Perry et al, 2016; Hendarman and Cantner, 2017; Schierjott *et al.*, 2018; Sarıköse and Türkmen, 2020)	*Satisfaction with life* (Ali, 2019; Hong *et al.*, 2021; Seifert *et al.*, 2022)
Spontaneity (Hendarman and Cantner, 2017; Gojny-Zbierowska and Zbierowski, 2021)	*Adoption of Innovation* (Theodosiou *et al.*, 2012; Perry *et al.*, 2016; Schierjott *et al.*, 2018; Kruft *et al.*, 2019; Reinhardt and Enke, 2020)	*Organisational Commitment* (McDermott and Prajogo, 2012; Perry *et al.*, 2016)
Creative self-efficacy (Slåtten, 2014; Nisula and Kianto, 2015; Liao *et al.*, 2021; Raihan and Uddin, 2023)	*Early adaptation* (Hendarman and Cantner, 2017; Ali, 2019; Schierjott *et al.*, 2018; Sarıköse and Türkmen, 2020)	*Loyalty* (McDermott and Prajogo, 2012; Perry *et al.*, 2016)
Tolerance for uncertainty (Hutchison-Krupat and Chao, 2014; Hendarman and Cantner, 2017; Audretsch *et al.*, 2017)	*Personal innovativeness* (Lu *et al.*, 2005; Yi *et al.*, 2006)	*Knowledge acquisition ties* (Löwik *et al.*, 2012; Schierjott *et al.*, 2018; Wu *et al.*, 2021)
Learning and conceptual skills (Murray and Blackman, 2006; Cavagnoli, 2011; Hendarman and Cantner, 2017; Bansal *et al.*, 2023)	*Ambiguity* (Perry *et al.*, 2016; Schierjott *et al.*, 2018)	*Improved performance* (Kyrgidou and Spyropoulou, 2012; McDermott and Prajogo, 2012; Perry *et al.*, 2016, M. Khan *et al.*, 2021)
Need for achievement (Khan *et al.*, 2015; Schierjott *et al.*, 2018; Maziriri *et al.*, 2022)	*Creating new things* (Hendarman and Cantner, 2017; Schierjott *et al.*, 2018; Kruft *et al.*, 2019; Llopis and D'Este, 2022)	*Technology acceptance* (Lu *et al.*, 2005; Jackson *et al.*, 2013; Akar and Güzin, 2019)
Task orientation (Nisula and Kianto, 2015; Afsar and Umrani, 2019; Thomas and Khalil, 2022)		
Perceived organisational support (Xerri, 2012; Nazir *et al.*, 2018; Nazir *et al.*, 2019; Le and Lei, 2019)		

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to novel ideas, practises or objects. Individual innovativeness is an enduring attribute which illustrates an individual's inherent disposition when subjected to an innovation (Lu *et al.*, 2005; Yi *et al.*, 2006, Jeon *et al.*, 2020). Individuals portray plenty of attitudes and behaviours, which Rogers (2003) characterises as dissemination of innovations, all through the course of accepting an innovation, readiness for transformation, becoming acquainted with an intriguing concept and implementing it into practise (Lu *et al.*, 2005; Yi *et al.*, 2006; Casanueva and Gallego, 2010; Xerri, 2012).

Via the job–demand resource theory, another prevalent theoretical stance on IO is put forth. This theory is aimed at addressing the link between creative endeavours and well-being, as innovations can be viewed as means that assist individuals towards accomplishing their objectives and enhancing their well-being (Ali, 2019; Choi *et al.*, 2021). Moreover, research has indicated that high levels of innovation have a strong positive association with well-being and vice versa (Ali, 2019). In addition, Ali (2019) applied the theory of personality traits, that postulates that individuals exhibit distinct personality characteristics and behave distinctively across various settings, to evaluate the bearing of personality traits on individual innovativeness and life satisfaction (Ali, 2019; Choi *et al.*, 2021).

The person–organisation fit theory is yet another prominent theory that underpins the domain of innovation. It contends that the majority of inventive individuals find a good fit within organisations that succour innovation, resulting in commitment (Perry *et al.*, 2016; Kristof-Brown *et al.*, 2023). This hypothesis is in conformity with the findings of Perry *et al.* (2016). Furthermore, social exchange theory could be leveraged as a prism to investigate several of the organisational aspects that contribute to the expansion of employees' innovative behaviour. In the view of social exchange scholars, social exchange entails encounter that, gradually, build liabilities and freedoms among individuals in an occupational social network. Employees' innovative behaviours, for instance, can be fostered and honed to boost productivity and efficacy (Xerri, 2012; Kristof-Brown *et al.*, 2023).

2.2 Definition and dimensionality

The term "innovation orientation" has been articulated from an array of viewpoints by numerous authors. IO is defined as an individual's urge for innovation (Lee *et al.*, 2011), a person's aptitude for learning new things and coming up with innovative ideas (Bouncken and Koch, 2007) and, it is also characterised as a proclivity for approaching tasks creatively, and optimise on novel methods (Perry *et al.*, 2016), and opt for unique, ambiguous situations where these novel methods can be fruitful (Perry *et al.*, 2016). Employees' IO is an ideal measure to assess candidates when organizations are seeking exemplary employees, as, individuals with higher IO are valiant and approach problems with a creative perspective (Ali, 2019).

In terms of product development, IO can also be viewed as an assortment of beliefs and opinions that promote the production of inventive new products (Nambisan, 2002). Finally, IO as an entrepreneurial attitude can be described the desire to encourage and engage in innovative ideas, processes and exploration (Schierjott *et al.*, 2018). As a strategic behaviour, IO exhibits both an openness to new ideas and a constant hunt for them (Theodosiou *et al.*, 2012). Innovation diffusion theory also asserts that a person's propensity to accept an innovation is a good indicator of how innovative they are (Lu *et al.*, 2005; Yi *et al.*, 2006; Jeon *et al.*, 2020). However, organisations face a perplexing dilemma in determining ways to acquire commitment from employees who do not readily embrace organisational norms and procedures (Perry *et al.*, 2016). Concerning the definition, dimensions and decoupling of IO from a firm's IO, there persists a great deal of uncertainty (Posch and Garaus, 2020). However, these definitions and theoretical underpinnings enabled us to pin down multiple IO dimensions, illustrated in Figure 1.

2.3 Antecedents

The primary individual-level antecedents of IO are creative self-efficacy, task orientation and individual creativity, which alludes to a person's propensity to generate distinctive concepts and endeavours (Nisula and Kianto, 2015). Soft skill sets like passion, optimism and tolerance for uncertainty, in conjunction with hard skill sets like conceptual skills, have been further acknowledged to facilitate IO (Hendarman and Cantner, 2017). In addition, need for achievement (Schierjott *et al.*, 2018) and perceived organisational support (Xerri, 2012) have *ad nauseam* demonstrated to be integral IO upholders (Table 1). In addition, employees with higher IO are anticipated to adopt new technology more readily and are more favourable of the chosen technology (Lu *et al.*, 2005) (refer Table 1).

2.4 Outcomes

Innovatively oriented employees experience a greater satisfaction and content with their lives (Ali, 2019). Employees with an elevated level of IO might additionally possess a sense of compatibility with their job because they hold an emphasis on adhering to a job that fosters inventive, artistic endeavours, which leads to enhanced commitment (Perry *et al.*, 2016), improved performance (McDermott and Prajogo, 2012) and loyalty (Perry *et al.*, 2016) to the organisation (McDermott and Prajogo, 2012; Perry *et al.*, 2016). IO has also shown to negatively impact employees' propensity to hinge on interpersonal relationships to acquire knowledge i.e. knowledge acquisition ties, as an employee strong on IO will be autonomous in their decisions (Schierjott *et al.*, 2018) (refer Table 1).

2.5 Existing measures

There are a variety of scales which gauge components that correspond to IO, however, there is an acute lack of individual IO-specific measurements. Hurt *et al.*'s (1977) 20-item scale to quantify individual innovativeness is among the more prevalent and ubiquitous scales throughout the innovation literature (Ali, 2019; Sarıköse and Türkmen, 2020). To expand on individual innovativeness in the biomedical setting, Llopis and D'Este (2022) constructed a validated 11-item individual innovativeness scale (Llopis and D'Este, 2022). The drive of an individual to experiment with the latest innovation is characterised by Agarwal and Prasad (1998) as personal innovativeness in the sphere of IT (PIIT). The PIIT scale gauges individual innovativeness along a facile spectrum spanning high to low (Yi *et al.*, 2006).

Various other scales have been adopted by innovation researchers to gauge IO, such as Janssen's (2000) 9-item innovative work behaviours scale (Llopis and D'Este, 2022, Adriano and Callaghan, 2022), Robinson *et al.*'s (1991) Entrepreneurial Attitude Orientation 75-item scale to measure IO (Perry *et al.*, 2016) and Adopter Category Innovativeness 14-item scale by Yi *et al.* (2006) (Yi *et al.*, 2006). Even so, relatively handful of studies have examined at IO in regard to an individual's readiness to engage with novel concepts. Due of the considerable emphasis on innovation as the outcome or from a firm's IO standpoint, there are scant IO measures to draw from. We intend to develop an IO scale that can exhaustively quantify the construct provided the sparse range of current measures. For additional clarity, Table 2 provides a tabular representation of existing measures of IO with brief descriptions.

3. Methodology

This study takes on a mixed-methods technique to construct our IO scale, encompassing both qualitative and quantitative designs in tandem. This strategy places a parallel emphasis on empirical evaluation and conceptualisation (Finn and Kayandé; 2005). We undertook five studies to conceptualise, develop and validate the IO scale, coalescing findings from varied scale development methods, as advocated by research connoisseurs

Table 2 Existing measures of IO

Scale	*Domain*	*No. of items*	*Dimensions*	*Gap*
Hurt et al.'s (1977) individual innovativeness scale	Students and teachers	20 items	Five innovativeness categories: innovator, early adopter, early majority, late majority, laggard	The scale is not generalised beyond students and teachers sample and displays poor convergent validity
Llopis and D'Este (2022)'s individual innovativeness scale	Biomedical setting, medical innovation	11 items	Four dimensions: product generation, drug development, clinical guidelines, diagnostics and prevention	The scale has not used Likert scale (drop down menu 0–10 for level of involvement in each dimension)
Agarwal and Prasad (1998)'s PIIT scale	Personal innovativeness in the domain of information technology	4 items	Unidimensional	The scale is unidimensional and only pertains to innovation regarding information technology and domain specific innovativeness
Janssen's (2000) innovative work behaviours scale	Individual innovative behaviour in the workplace	9 items	Three dimensions: idea generation, idea promotion, idea realisation	This scale is built on categories, i.e. typologies of innovators, which runs counter to the study's aims, which are to focus on individuals' dispositions towards innovation
Robinson et al.'s (1991) EAO scale	Entrepreneurial attitude orientation; studies four possible attitudes associated with entrepreneurship (achievement, self-esteem, personal control and innovation)	75 items	Four sub-scales: achievement (23 items), self-esteem (14 items), personal control (12 items) and innovation (26 items); each scale has 3 components: affect, cognition and conation	This scale focuses on entrepreneurial mindsets, and innovation is not the primary construct under research, hence, it lacks to sufficiently measure IO
Yi et al.'s (2006) ACI scale	Adopter category innovativeness; individual characteristics that affect acceptance decisions for technologies	14 items	Four adopter categories: innovative adopters, early majority, late majority, laggard	This scale focuses on categories of innovators contrary to the study's objectives, which are to focus on individuals' orientations towards innovation

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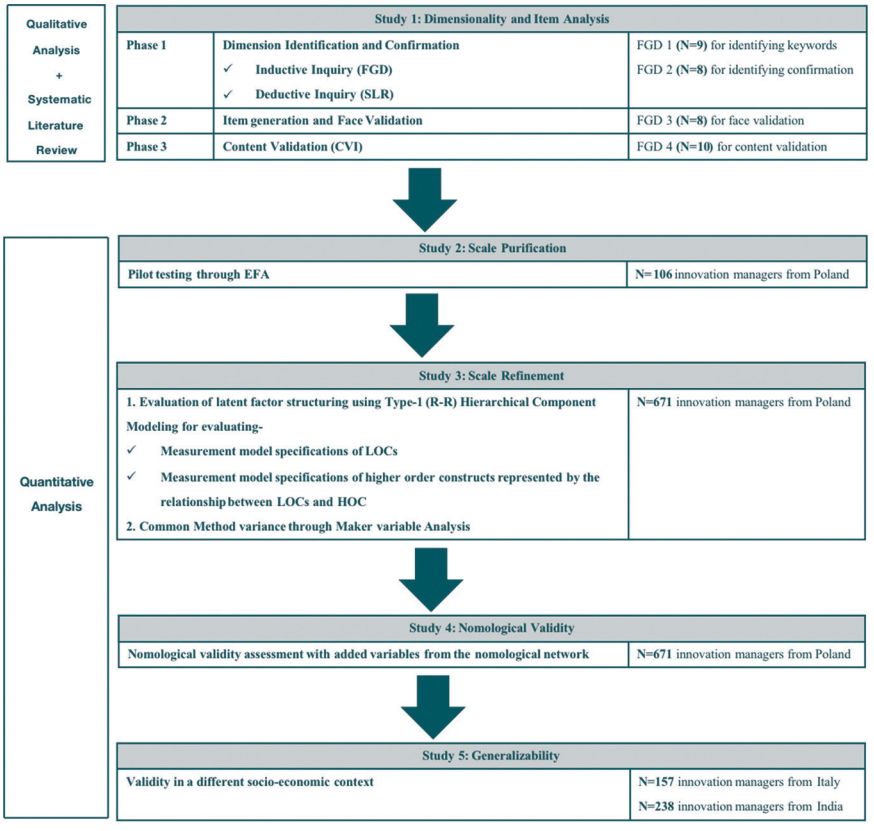
(Churchill, 1979; DeVellis, 2017; Finn and Kayandé; 1997; Hinkin, 1998; Netemeyer *et al.*, 2003; Rossiter, 2002). Figure 2 illustrates a summary of these studies.

3.1 Procedures and sampling

3.1.1 Study 1. Study 1 was concerned with formulating a validated item pool for evaluating IO. Both inductive as well as deductive techniques were adopted for accomplishing this. To engineer this end, an exhaustive, systematic review of the literature on IO was executed. Web of Science served as the database for the systematic review. Pertinent articles were sought out using quality criteria stipulated on SSCI indexed articles solely in English language. Only articles that dealt with management disciplines were chosen as per the inclusion criteria, further streamlining the studies. Articles from other domains were excluded in accordance with the research aims. Only studies that addressed individual IO were chosen from the abstracts of the included studies, while the articles centred on organisational IO were further obliterated. The final article sample was reviewed for content bearing. The ADO framework was adopted to evaluate and synthesise the shortlisted articles (Paul and Benito, 2017). The dimensions of IO emerged through the full-text articles, and the focus group discussions (FGD) corroborated these findings/dimensions. Following

Figure 2 Aspects and statistics to consider in scale development and validation process



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the genesis of the initial items, a second FGD was held for face validation. The CVI technique was then used for content validation, which was undertaken by a panel of 10 experts who scored the relevance of items. Items that did not meet the requisite threshold were then dropped (Lynn, 1986; Polit and Beck, 2006).

3.1.2 Study 2. A pilot survey was administered in Study 2 for purification of measurement items. The scope of this study was confined to knowledge workers in Poland. In particular, the survey was addressed to innovation managers, as a category of knowledge workers for whom IO is especially relevant. A sample typical of the general populace of 106 participants was used. Following that, exploratory factor analysis (EFA) was performed to pare down the items.

3.1.3 Study 3. The third study was geared towards scale refinement. Data for the study was secured through a commercial Polish agency. Again a sample of innovation managers was considered, as a category representative of knowledge workers. These are individuals in charge of implementing changes to improve a firm's productivity as well as effectiveness at any stage throughout its operations. Respondents were chosen from six industries. The applications were routed out using simple random sampling, yielding 671 viable responses. Using Type 1 (reflective–reflective), hierarchical component modelling (HCM), the latent factor structure was analysed. With the help of confirmatory factor analysis (CFA), model fit indices, construct reliability and validity were determined. In addition, to combat the issue associated with common method bias, marker variable analysis was performed.

3.1.4 Study 4 and 5. The fourth study sought to ascertain the nomological validity of IO on the same sample. Pursuant to the systematic review's findings, an outcome variable from the nomological network of IO, individual creative performance, was discovered. Study 5 was undertaken to look into the IO scale's generalizability so as to validate the scale in a diverse socio-economic context. To that purpose, two independent samples of 157 Italian innovation managers and 238 Indian innovation managers were opted for. A second CFA was performed to review the measurement model. The steps taken for the development and validation of the IO scale are outlined in the section that follows.

4. Scale development

4.1 Study 1: Dimensionality and item analysis

4.1.1 Dimension identification and dimension confirmation. Constructs are theoretically intriguing phenomena that call for definitive conceptualisation for operational measurement (Edwards and Bagozzi, 2000). It is imperative for measuring constructs accurately as ill-defined constructs may give rise to flawed measures that fall short to appropriately reflect the construct (Rossiter, 2002). The clarity of the way the meaning and syntax of the construct is laid out alters the measurement's quality (Carpenter, 2018). In furtherance to the rigorous systematic literature review, we additionally executed a FGD aimed at identifying the empirical traits best characterising IO. Given that it enables the incorporation of target population standpoints, builds on prior research and facilitates alteration based on emerging knowledge, a hybrid of inductive (FGD) and deductive (SLR) methodologies is preferable to developing new scales (Kapuscinski and Masters, 2010; Zheng *et al.*, 2015). A second focus group was additionally held to be certain that all relevant dimensions were reflected in the dimension table. The dimensions illustrated in Table 1 were next evaluated by a panel of eight specialists, which included three researchers (one from each nation), three innovation managers and a pair of specialists in research methodology. It was recommended that the dimension of Adopter Category Innovativeness be dropped since it pertains to a specific category of innovators. Due to overlaps, it was additionally recommended that the dimensions of openness to new ideas and willingness to try new things be combined.

4.1.2 Item generation and face validation. Following dimension confirmation, a next phase was to formulate a pool of items, built around the dimensions identified and then choosing those items exhibiting face validity. At this point, a third FGD took place for determining face validity. A focus group of eight people, comprising of three researchers, three innovation managers and two specialists in research methodology, reviewed the pool of items on the grounds of language coherence, prolixity and response types (Netemeyer *et al.*, 2003; Papadas *et al.*, 2017). At this point, nine items were removed and four were introduced. Seven items were revised to improve their lucidity. The content validity of 27 face validated items was subsequently established.

4.1.3 Content validity using content validity index. Content validity, which is paramount in warranting the success of any newly developed instrument, renders evidence concerning an instrument's validity by analysing how far the instrument represents the construct in question (Polit and Beck, 2006; Rossiter, 2002, Rusticus, 2014). CVI is an emphatically cardinal indicator of content validity (Clemmensen *et al.*, 2020). Accordingly, we opted for the CVI approach for gauging the content validity of the IO scale (Kovacic, 2017; Lynn, 1986). We pursued the systematic six-step approach laid out by Yusoff (2019) for computing CVI. These steps are outlined herein: The process starts out by drafting the content validation form that is provided to the experts in addition to a comprehensive guidance on how to assess the items' shared content for relevance, such as an accurate definition of the construct to enable accurate rating (Yusoff, 2019). In accordance with Polit and Beck's (2006) advocacy, the scoring metrics were followed, with 4 denoting "highly relevant" and 1 denoting "not relevant".

In the next step, a panel of 10 content experts was assembled to gauge the content validity, on the recommendation of Polit *et al.* (2007). The expert selection parameters were reflective of either generic scale development methodologists or topical experts in the field of innovation. The third step was to hold a FGD with an expert panel to validate the content. Making use of the content validation form, every expert, denoted by E1-E10, were tasked with scoring the significance of each item underpinning the construct. The panel of experts autonomously rated every item on the scale in the subsequent step. Experts were entrusted with reviewing the scale items and rating them whilst taking into factoring the definition as specified in the form. After rating each item distinctly, experts reported their forms to the researchers in the fifth step. Relevance ratings of 3 or 4 were encoded as 1, whereas ratings of 2 or 1 were encoded as 0 (Almanasreh *et al.*, 2019). In conclusion, ratings were computed with two forms of CVI: I-CVI and S-CVI. I-CVI assesses content validity at the item level, whereas S-CVI corresponds to the entirety of the scale (Polit *et al.*, 2007). S-CVI can further be reported in two ways: S-CVI/Ave and S-CVI/UA.

4.1.3.1. Item-wise content validity index. The values for I-CVI for each item on the scale were calculated by dividing the number of experts in agreement with total number of experts. The I-CVI threshold for over nine experts is considered 0.78 and higher (Davis, 1992; Polit and Beck, 2006; Yusoff, 2019; Lynn, 1986).

4.1.3.2 Experts in agreement. Experts in agreement (A) are a sum of relevance scores assigned by the $n = 10$ experts for each item.

4.1.3.3 Universal agreement. The universal agreement (UA) is derived by ranking items as 1 or 0. Items with a relevance value of 3 or 4 from all experts are allocated 1, while items with even one expert disagreeing are allocated 0.

4.1.3.4 Modified kappa. Modified kappa (κ^*) statistic was additionally generated applying the following formula to account for the possibility of incidental agreement within the team of experts:

$$\kappa* = \frac{ICVI \quad P_c}{I \quad P_c} \tag{1}$$

where P_c denotes the chance probability and is computed as follows:

$$P_{c=} N!/A!(N \quad A)! * 0.5^N \tag{2}$$

Only items with I-CVIs of 0.78 and greater; and κ^* greater than 0.75 were kept, resulting in the final instrument encompassing 24 items, all of which were rated excellent.

4.1.3.5. Scale-level content validity index. Following I-CVI, S-CVI was computed. S-CVI is undertaken to assess the overall content validity of the entire scale; and was calculated via S-CVI/Ave and SCVI/UA. In juxtaposition with S-CVI/UA, S-CVI/Ave is simpler and is recommended when the number of experts is more.

4.1.3.6 Scale-level content validity index/universal agreement. The odds of finding suitable S-CVI/UA values falls as the number of experts rises due to the prospect of inadvertent disagreement. With a large number of experts participating in our study, a low S-CVI/UA score was anticipated. The S-CVI/UA value came up to be 0.55 (=15 / 27), computed by evaluating the proportion of items with unanimous agreement from all experts. Fifteen is the number of items with unanimous agreement and 27 is the total number of items.

4.1.3.7 Scale-level content validity index/Ave. Subsequently, the S-CVI based on I-CVI was computed. S-CVI/Ave is derived by averaging the I-CVI scores for all items, with a threshold of 0.90. The S-CVI/Ave value for the IO scale was 0.904 (24.4 = /27; 24.4 is the sum of all I-CVIs and 27 is the total number of items), indicating the overall validity of the scale (Waltz *et al.*, 2016; Almanasreh *et al.*, 2019).

4.2 Study 2: Scale purification

The 24-item scale was pilot tested during the scale purification stage, and data was acquired through a self-administered questionnaire of seven-point Likert scale, ranging from 1 =← strongly disagree and 7 = strongly agree. In line with the standard criteria mandating a pilot-test sample size ranging from 50 and 100 participants, a sample size of 106 participants was thought to be adequate for carrying out EFA (Carpenter, 2018) (refer Appendix Table A2).

Pilot testing was performed on these 24 items (with I-CVI $\geq$ 0.78, κ^{*}>0.75 and S-CVI/Ave $\geq$ 0.9). Appendix features an entire set of the final sample of items, expert ratings and index computations.

Primarily, a sample suitability for EFA was reviewed preceding to factor extraction. Using the Keiser–Meyer–Olkin (KMO) test (Kaiser and Rice, 1974) and Bartlett's test of sphericity (Bartlett, 1950), the factorability of the data set was measured. KMO yielded a value of 0.812, which is higher than the lower-bound of 0.6 required to establish sampling adequacy. Bartlett's test of sphericity (999.042, df. 171, p <0.001) shows that the values are significant and, hence, acceptable, implying that variables in the population correlation matrix are correlated at the significance level of 0.000. Thus, our sample provides an adequate basis for continuing with factor analysis (Hair, 2010).

We subsequently carried out a principal components analysis on the 24 items retained from Study 1's last phase via varimax rotation along with Kaiser normalisation (SPSS 24.0) in so as to empirically characterise the dimensionality of the IO scale. Items with communalities and factor loadings less than 0.5 were omitted. Items that cross-loaded on two or more factors concurrently were eliminated as well. Following that, any items that loaded onto factors with eigenvalues below one were eliminated. After 6 iterations, this culminated to a 19-item, 5-factor solution for IO (see Table 3), accounting for 68.124% of variance, exceeding the minimum acceptable standard of 60% (Hair, 2010). The IO scale surpasses the threshold for overall scale reliability, 0.7 (Nunnally, 1978), with overall reliability of 0.86, exhibiting significant internal consistency of each dimension (Table 3). The five factors of IO have been characterised as creative orientation, learning orientation, first-mover orientation, trust orientation and agility orientation.

4.3 Study 3: Scale refinement

4.3.1 Evaluation of latent factor structure. In a bid to determine the model fit and confirm the dimensionality of the IO scale, a CFA was additionally conducted. SMARTPLS 4.0 was used to validate the latent factor structure by means of partial least squares structural equation modelling (PLS-SEM) (Table 4). For determining the relationship between the construct and its indicators, the HCM method (Jarvis *et al.*, 2003) was implemented. With its lower-order components (LOC), which are more practical, and its higher-order components (HOC), which are more conceptual, HCM provides a framework for modelling a construct (Sarstedt *et al.*, 2019). IO was envisioned as a Type 1 HCM with reflective first order and reflective second order. In other words, IO is a reflecting–reflective, second-order construct, in tandem with lower-order reflective constructs including creative orientation, learning orientation, first-mover orientation, trust orientation and agility orientation. Examining the measurement model specifications of LOCs and HOC, which is identified by relationships between HOCs and its LOCs (Sarstedt *et al.*, 2019; Wetzels *et al.*, 2009), is imperative to establish higher-order constructs. In conjunction with this, we will examine the measurement attributes of the higher-order construct in its entirety and the latent factor structure for LOCs.

4.3.1.1 Measurement model specifications of lower-order components. We probed indicator reliability, internal consistency reliability, convergent validity and discriminant validity to gauge the measurement characteristics of the reflective-formative higher-order index.

Table 3 Exploratory factor analysis (EFA)

Components→ item↓	*Creative orientation*	*Learning orientation*	*First-mover orientation*	*Trust orientation*	*Agility orientation*
I use critical thinking skills to evaluate alternative solutions	0.755				
I think I have the requisite skills to think outside the box	0.736				
I trust my innovative thought process	0.736				
I seek out new ways to do things	0.736				
I consider myself to be creative in my thinking	0.727				
I have the skills to explore innovative ways to increase efficiency	0.669				
I am creative in my methods of operation	0.665				
I keep learning new technologies		0.85			
I keep acquiring new skill-sets that will help me become more innovative		0.765	.		
I keep researching industry trends to stay ahead of the curve		0.714			
I have the requisite technical design skills for developing the latest in my field		0.665			
I am recognised for being at the leading edge of technological innovation			0.83		
I am the first one who brings new ideas towards product and services			0.752		
I often discuss new ways of doing things with my leader			0.689		
I am not suspicious of new inventions and new ways of thinking				0.805	
I trust new ideas even if I can't see whether the vast majority of people around me accept them				0.725	
I don't need to see other people using new innovations before I consider them				0.653	
I am challenged by unanswered questions					0.867
I am challenged by ambiguities					0.85
Eigen value	*6.930*	*2.024*	*1.498*	*1.301*	*1.218*
Cronbach's α	*0.91*	*0.90*	*0.83*	*0.79*	*0.80*
Total variance explained	*68.124%*				

Source: Created by authors

In addition, we examined the outer loadings to measure the indicator's reliability (Hair *et al.*, 2019)(Refer Table 4). Loadings $\geq$ 0.708 tend to be permissible, which is valid for nearly all of the items retained. Conversely, indicators with loadings that occur between 0.4 and 0.7 in social science studies, particularly with the establishment of new scales, should solely be taken into account for elimination in two circumstances: firstly, when their corresponding internal consistency, reliability and convergent validity values drop beneath minimum acceptable levels, and secondly, when removal is not detrimental to content validity. Cronbach's α composite reliability (ρ_c) and reliability coefficient (ρ_a) were used for assessing internal consistency reliability. Our scale satisfies the 0.7–0.95 acceptable criterion for the same, confirming the internal consistency reliability of the scale. We probed the average variance extracted (AVE) criterion for our five LOCs to ascertain the convergent validity of the construct. The AVE values notably exceed the criterion of 0.5, ranging from 0.696 to 0.847, demonstrating that all LOCs account for more than 50% of the variance of respective items. Resultantly, we retained all of the indicators because AVE, Cronbach's α, ρ_c and ρ_a all exceed above the predetermined levels (refer Table 4).

Each item's correlation to the LOC to which it is conceptually analogous is most significant, and the loading of an item on a comparable LOC has a higher value than any cross-loadings on other LOCs. Accordingly, one item from the dimension of trust orientation was dropped. Ergo, the construct's discriminant validity at the item level has been determined (Gefen and Straub, 2005) (see Appendix).

4.3.1.2 Measurement model specifications of higher-order components. We administered a Type 1 reflective–reflective, second-order CFA by loading the five LOCs onto the HOC so

Table 4 Measurement model summary for LOCs ($n = 671$)

LOC	Identifier	Indicator	Indicator reliability Loadings	Internal consistency reliability α	ρ_a	ρ_c	Convergent validity AVE
CO				*0.927*	*0.928*	*0.941*	*0.696*
	IO_CO_1	I use critical thinking skills to evaluate alternative solutions	0.667				
	IO_CO_2	I think I have the requisite skills to think outside the box	0.633				
	IO_CO_3	I trust my innovative thought process	0.724				
	IO_CO_4	I seek out new ways to do things	0.807				
	IO_CO_5	I consider myself to be creative in my thinking	0.79				
	IO_CO_6	I have the skills to explore innovative ways to increase efficiency	0.746				
	IO_CO_7	I am creative in my methods of operation	0.634				
LO				*0.878*	*0.878*	*0.916*	*0.732*
	IO_LO_1	I keep learning new technologies	0.77				
	IO_LO_2	I keep acquiring new skill-sets that will help me become more innovative	0.815				
	IO_LO_3	I keep researching industry trends to stay ahead of the curve	0.789				
	IO_LO_4	I have the requisite technical design skills for developing the latest in my field	0.75				
FMO				*0.857*	*0.859*	*0.913*	*0.779*
	IO_FMO_1	I am recognised for being at the leading edge of technological innovation	0.896				
	IO_FMO_2	I am the first one who brings new ideas towards product and services	0.892				
	IO_FMO_3	I often discuss new ways of doing things with my leader	0.751				
TO				*0.604*	*0.611*	*0.834*	*0.715*
	IO_TO_2	I trust new ideas even if I can't see whether the vast majority of people around me accept them	0.897				
	IO_TO_3	I don't need to see other people using new innovations before I consider them	0.893				
AO				*0.819*	*0.819*	*0.917*	*0.847*
	IO_AO_1	I am challenged by unanswered questions	0.894				
	IO_AO_2	I am challenged by ambiguities	0.918				

Notes: LOC = Lower-order construct; AVE = average variance extracted; AO = agility orientation; creative orientation = CO; first-mover orientation = FMO; learning orientation = LO; trust orientation = TO; Cronbach's alpha = α; reliability coefficient = ρ_a; composite reliability = ρ_c

Source: Created by authors

as to look into the second-order factor structure more extensively. As factor loadings varied between 0.787 to 0.886, the minimum threshold for factor loadings was duly met. Cronbach's α, ρc and ρa values were additionally found to be over 0.7 (Bagozzi and Yi, 1988; Hair *et al.*, 2019; Sarstedt *et al.*, 2021) (Table 5). Table 6 highlights the HTMT criterion that has been used for assessing discriminant validity, and all values under an upper threshold of 0.9 (Hair *et al.*, 2021) have been stated for conceptually comparable constructs (Henseler *et al.*, 2015). The entirety of the IO construct has an AVE value of 0.709, suggesting convergence between the five LOCs assessing this construct. In addition, the CFA findings obtained exhibited an adequate model fit with appropriate fit indices [Standardized root mean squared residual (SRMR) = 0.046].

4.3.2 Common method variance (CMV). Common method bias is described as probable variations in actual correlations within observed variables in a study as a consequence of inappropriate measurement methods (Podsakoff *et al.*, 2003; Malhotra *et al.*, 2016). We made use of the marker variable of fashion consciousness, that is conceptually separate

Table 5 Measurement model summary for HOCs

HOC	*Reflective indicators*	*Indicator reliability* *Loadings*	*Internal consistency reliability* α	ρ_a	ρ_c	*Convergent validity* AVE
IO			0.897	0.901	0.924	0.709
	CO	0.886				
	LO	0.886				
	FMO	0.838				
	TO	0.808				
	AO	0.787				

Notes: HOC = Higher-order component; AVE = average variance extracted; innovation orientation = IO; agility orientation = AO; creative orientation = CO; first-mover orientation = FMO; learning orientation = LO; trust orientation = TO; Cronbach's alpha = α; reliability coefficient = ρ_a, composite reliability = ρ_c
Source: Created by authors

Table 6 HTMT ratio of correlations between LOCs

LOCs	*AO*	*CO*	*FMO*	*LO*	*TO*
AO					
CO	0.757				
FMO	0.681	0.689			
LO	0.697	0.85	0.828		
TO	0.753	0.886	0.834	0.851	

Notes: HOC = higher-order component; AVE = average variance extracted; agility Orientation = AO; creative orientation = CO; first-mover orientation = FMO; learning orientation = LO; trust orientation =← TO; Cronbach's alpha = α; reliability coefficient = ρ_a; composite reliability = ρ_c
Source: Created by authors

and not related to the remaining constructs in the study, to deal with common method variance (CMV). It was computed through the item "I am very alert to changes in fashion". The findings confirm that CMV was not detrimental in this study as the relationship between MV and IO was insignificant ($\beta = 0.027$, $p = 0.19$). Furthermore, the difference between the R^2 values prior to and subsequent to using MV was well under the acceptable threshold of 10% (Ahmad *et al.*, 2020).

4.3.3 Tetrad analysis. We further tested the model specifications via a confirmatory tetrad analysis (CTA-PLS). CTA-PLS allows for empirical verification of measurement model specifications. Tetrads, or disparities in pairings of covariances across indicators, on which CTA-PLS is predicated, were examined to corroborate the construct's formative or reflective nature (Hair *et al.*, 2019). Given the ensuing tetrads' confidence intervals comprised of zero values, and was deemed to be nonsignificant (Bollen and Ting, 2000; Noor *et al.*, 2022). This substantiated the assertion of our study that IO is an empirically verified reflective construct.

4.4 Study 4: Nomological and predictive validation

4.4.1 Predictive validity. With regard to the intent of measuring the predictive validity of the postulated scale, the causal relationship between IO and individual creative performance (ICP) served as an anchor of reference. To explore this relationship, we relied on Zhou and George's 13-item ICP scale (Zhou and George, 2001). An emphasis on IO stimulates individual creative behaviour, pursuant to the body of extant literature (Simpson *et al.*, 2006; Goepel *et al.*, 2012; Christensen *et al.*, 2018), as embracing innovation competently may stimulate creativity as well as performance, as the ability to innovate furnishes an avenue to boosting one's creative performance. Since innovativeness and creative performance have been found to be positively correlated (Choi, 2004; Christensen *et al.*, 2018), we

hypothesise that H1. IO has a positive and significant effect on ICP Christensen *et al.* (2018) have recommended conducting an empirical analysis of this relationship. We, therefore, hypothesise a casual relationship between IO and ICP Chen *et al.* (2015):

H1. IO has a positive and significant effect on ICP.

ICP was shown to be positively and significantly influenced by IO ($\beta = 0.14$, $p < 0.001$), highlighting that high IO levels wore a favourable impact on employee ICP. Existing work that contends the causal nature of the relationship between IO and creative performance lends credence to this result in turn. Our scale, hence, exhibits predictive validity by empirically verifying the causal relationship underlying IO and ICP at a micro-level positioned underneath the organisational framework.

4.4.2 Nomological validity. The nomological validity was tested on a nomological network as given by the ADO framework (refer Table 1) of IO consisting of four constructs identified through the literature and selected by the focus group of experts. Nomological validity can be attained by integrating the construct within a nomological net of theoretically related constructs with at least one antecedent and/or outcome variable (Köck *et al.*, 2024). The nomological network of IO, therefore, comprised of agile leadership (Le and Lei, 2019; Ye *et al.*, 2020; Fernandes *et al.*, 2023), individual creative self-efficacy (Nisula and Kianto, 2015; Raihan and Uddin, 2023) and individual creative performance (Simpson *et al.*, 2006; Goepel *et al.*, 2012; Christensen *et al.*, 2018). All values were significant and well within the range ($\beta > 0.70$; $p < 0.05$).

Hypothesis	*Path*	*β*	*CI*	*Outcome*
H1	IO → ICP	0.809	(0.7, 0.817)	Supported

Notes: Beta = β; Confidence interval = CI
Source: Authors' own calculations

4.5 Study 5: Generalizability

Upon affirming the validity and reliability of our IO scale among Polish innovation managers, our subsequent objective was to ensure the scale's validity in an alternate socioeconomic milieu to harness measurement scale's equivalences when reiterating studies that took place in certain cultural scenario (Roy and Singh, 2022). Individualism, a fundamental cultural aspect signifying the extent wherein individuals prioritise self over group, emerges as a discerning facet in this respect. Societies that uphold individualism substantially place a premium on self-interest and autonomy while less individualistic societies position a greater emphasis on fidelity and group loyalty. We uncovered two nations, Italy and India, that fell on both the extremes of the individualism gamut and correspondingly, in light of the fairly individualistic temperament of Polish culture (Načinović-Braje *et al.*, 2019).

We recollected data from both of the additional samples and reviewed if comparable latent factors were observed throughout each of the three groups to validate our measurement scale in an overtly individualist society (Italy) and a minimally individualised society (India). CFA was carried out, yielding adequate model fit indices (SRMR = 0.076). IO was developed as a Type 1, reflective–reflective, second-order construct adopting the HCM method, using the identical latent factor structure as Poland. Both Italian and Indian samples' loadings, Cronbach's alpha and composite reliability were deemed adequate (see Table 7). It was discovered that the factor loadings for both the nations is analogous, demonstrating that regardless of the cultural scenarios, and where the individual is set, IO is an intrinsic variable and henceforth, established as a function of creative orientation, learning orientation, first-mover orientation, trust orientation and agility orientation. Considering all indicated values for AVE > 0.5 and HTMT < 0.85 (Hair

Table 7 Measurement model for scale generalizability

		Italy					India				
			Internal consistency reliability					Internal consistency reliability			
HOC	*Reflective indicators*	*Indicator reliability Loadings*	α	ρ_a	ρ_c	*Convergent validity AVE*	*Indicator reliability Loadings*	α	ρ_a	ρ_c	*Convergent validity AVE*
IO			0.874	0.888	0.909	0.669		0.842	0.86	0.888	0.615
	CO	0.884					0.838				
	LO	0.872					0.842				
	FMO	0.771					0.828				
	TO	0.848					0.764				
	AO	0.699					0.629				

Source: Created by authors

et al., 2021), respectively, convergent and discriminant validity have been determined. Consequently, the IO scale's validity has been found in an array of socioeconomic environments, spanning highly individualistic to less individualistic societies. It indicates that the scale can be leveraged by innovation managers in all countries, independent of how individualistic their cultures may be.

5. Discussion

In this study, we have constructed and validated a scale for evaluating IO using a stringent multi-study research method. IO has been identified by empirical analysis to be a second-order, reflective–reflective construct with 19 factors and 5 dimensions. The scale has appropriate levels of nomological validity, convergent validity, reliability and discriminant validity. Employees regard IO as a function of creative orientation, learning orientation, first-mover orientation, trust orientation and agility orientation, pursuant to the results.

To start with, *creative orientation* symbolises the degree by which an array of individuals has a propensity towards creative ventures. It accentuates the value of varying elements including critical thinking abilities, inventive thought processes, openness to new experiences and flexibility of thought. These factors together characterise the creative orientation of an knowledge workers (Simner *et al.*, 2022; Koch *et al.*, 2023). *Learning orientation* then centres on accumulating fresh insight or cognition. The learner's preferred method of learning is reflected in their learning orientation. It delves into people's inclination to learning and researching novel competencies to keep up to date (Mutonyi *et al.*, 2020; Annosi *et al.*, 2020; Woo and Kim, 2022). The subsequent factor of *first-mover orientation* reiterates the vitality of being the first to set foot on an endeavour while pioneering manoeuvres to be at the forefront of innovation (Lowe and Atkins, 1994; Chen *et al.*, 2023). In addition, t*rust orientation* takes in workers' faith in new innovations on their arcing knowledge quest. With regard to innovation, trust can be summed up as the expectation of fair and favourable replies from others when faced with one's innovative endeavours (Mitcheltree, 2021). Finally, with agility orientation, we discover the vitality of being orientated towards intellectual severity while being confronted by anomalies and unanswered questions. Uncertainties characterise innovations. This dimension functions as a means of dealing with these ambiguities (Brand *et al.*, 2019; Schöck *et al.*, 2023).

6. Conclusion and implications

Innovation is an indispensable phenomenon that is assessed at numerous levels, and in an array of fields, given that it is the cornerstone of a firm's subsistence and germination. The innovation capacity of organisations is contingent to a good deal on the facets of the individuals who work within them. In particular, it is imperative to commiserate thoroughly the characteristics of those individuals, called knowledge workers, who contribute more

than others to ensuring that the organisation learns, adapts to the environment and is capable of innovating. Among the characteristics of knowledge workers, IO is particularly important for the innovative performance of the organisation. However, as was already indicated, research into knowledge workers' IO is still in its infancy. In conjunction with this, we constructed and validated a scale for evaluating IO in this study. The 19-item IO scale will be a useful tool that researchers in the future may easily use. Its practicality transcends past basic measuring, succouring as an impetus for study into the linkages underlying innovation and related constructs. Consequently, this research renders an extensive overview of knowledge workers' IO. In addition to its imminent scholarly benefactions, this study offers paramount managerial implications, accentuating the urgency of cultivating employees' IO as a means advance intended organisational objectives.

6.1 Theoretical implications

Whilst the knowledge economy is faced with employees' altering expectations and requirements, there is an ever-present demand for both conceptual coherence and methodological proficiency regarding IO. The insights proposed in this section reflect our significant contributions to the methodological soundness and conceptual structure that pertain to the IO construct. A glaring drawback in present corpus of research is the paucity of a validated employee-centric IO measure. With the IO scale, this study spans this gap. The IO scale has been established making use of an exhaustive mixed-methods strategy that draws on existing literature, qualitative research and advanced empirical analysis. The meticulous methodology used in the scale development procedure contributes in elevating social sciences research to the stringent standards set by scientific research. This study stands out due in the way it quantifies content validity using CVI (Polit *et al.*, 2007), assesses nomological validity using PLS-SEM and establishes the scale's generalizability. The scale development approach serves as a benchmark for prospective scale development methodologists. The scale additionally broadens our comprehension of IO and renders novel groundwork for developing theoretical understanding of its antecedents and outcomes. Notably, the current research additionally identified that IO significantly effects ICP. This outcome certainly supports our assertion that IO is a valid and reliable scale with predictive capabilities, whereas it also empirically proves the existence of a strong relationship between IO and ICP that has been merely hypothesised in the scientific literature, thus, far. This study integrates acumen of the intended groups-knowledge workers, academic experts and experts in methodology. This study offers exacerbated methodological austerity while begetting a benchmark for prospective scholars by using the CVI technique, as integrative methodologies that pledge flawless content validity (Polit *et al.*, 2007) still lack representation in the social science field. This study's vigilant conformity to scale development standards ensues in a reliable IO measure. As scholastic studies of IO get progressively thorough, this research serves as an indispensable vade mecum.

6.2 Practical implications

Being the propellers of knowledge economies, employees' IO pervades the larger societal fabric. Our study aims to uncover concrete solutions that stakeholders could use for bettering IO of employees. From a managerial standpoint, the study bestows managers/leaders concerning how to nurture IO in employees so as to tap into their concealed innovators. Innovatively oriented employees are often known to be noncompliant with the everyday tasks as they may find it mundane. Therefore, organisations are susceptible to having trouble securing commitment from employees that may not readily adhere to organisational rules and mechanisms owing to their innovativeness. The scale makes it viable to quantify IO in knowledge workers, empowering targeted attempts to be made to recognise, foster and shepherd innovative employees effectively paving the way for the fulfilment of sought organisational goals. Employers will gain a stronger grasp of the attributes of IO with the backing of the dimensions of IO set forth in this study. By using the

IO scale, it will be plausible to assess the domains in which a knowledge worker is deficient and devise a plan of action for development and training tailored to them. This study affirms creative orientation, learning orientation, trust orientation, first-mover orientation and agility orientation as fundamental facets of IO. These dimensions comprehensively characterise the multi-dimensional construct, and every single of the discovered five dimensions may function as a hallmark for organisations in formulating tactics and procedures for bettering employee's IO. To encourage IO in their workforce, organisations may devise holistic development and training protocols that centre on the five dimensions that have been emphasised. It is imperative that structured initiatives be taken that assist employees strengthen their creative, learning, trust, first mover and agility orientations. Employees, the economy and the organisation itself will all reap the rewards by encouraging IO in these raucous times. Coupled in tandem, this study advertises stakeholders to foster IO into their organisational settings so as to promote panoramic progress.

7. Limitations and future research agenda

The proposed findings from study must be gauged with certain limitations. Firstly, the study's results are based on samples taken from knowledge workers from three countries: Poland, Italy and India. Previous research indicates potential variations in IO across different cultures. Every culture, whether European, Japanese or Singaporean, is unique, and, hence, varied cultural milieu persist, implying that variations in IO might exist across cultures, which future studies may explore (Kaasa and Vadi, 2010; Svarc *et al.*, 2019; Shen *et al.*, 2020). Consequently, future research endeavours should aim to validate the proposed scale with a diverse global sample. Secondly, we considered a specific category of knowledge workers, namely, innovation managers. Future study should validate the scale across different types of knowledge workers. Finally, since a validated IO scale has been developed, IO may now be studied in relation to individual creative performances by future academics. This study's IO scale can be applied to future models that incorporate IO and ICP.

8. Acknowledgent

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Appendix

Table A1 List of retained items for data collection after CVI assessment

S. No.	Item code	Items	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	N	A	N A	UA	I-CVI	Pc	κ^*	Interpretation
1	Item 1	I am not suspicious of new inventions and new ways of thinking	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0. 76563	1	Excellent
2	Item 2	I trust new ideas even if I can't see whether the vast majority of people around me accept them	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
3	Item 3	I don't need to see other people using new innovations before I consider them	1	1	1	1	1	1	1	1	0	1	10	9	1	No	0.9	0.009765625	0.89901380	Excellent
4	Item 5	I am usually one of the first people in my group to accept something new	0	0	1	1	1	0	1	0	1	1	10	6	4	No	0.6	0.205078125	0.49680589	Fair
5	Item 6	I am receptive to new ideas	1	1	1	0	0	1	1	1	1	1	10	8	2	No	0.8	0.043945313	0.79080694	Excellent
6	Item 7	I am updated with the latest in technology	0	1	1	1	1	1	0	1	1	1	10	8	2	No	0.8	0.043945313	0.79080694	Excellent
7	Item 8	I am good at creating new combinations from old elements	1	1	0	1	1	0	1	0	1	0	10	6	4	No	0.6	0.205078125	0.49680589	Fair
8	Item 10	I consider myself to be creative in my thinking	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
9	Item 11	I seek out new ways to do things	1	1	1	1	1	1	0	1	1	1	10	9	1	No	0.9	0.009765625	0.89901380	Excellent
10	Item 12	I am creative in my methods of operation	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
11	Item 13	I think I have the requisite skills to think outside the box	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
12	Item 14	I trust my innovative thought process	1	1	1	1	1	0	1	1	1	1	10	9	1	No	0.9	0.009765625	0.89901380	Excellent
13	Item 15	I have the skills to explore innovative ways to increase efficiency	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
14	Item 16	I use critical thinking skills to evaluate alternative solutions	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent

(*continued*)

Table A1

S. No.	Item code	Items	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	N	A	N A	UA	I-CVI	Pc	κ*	Interpretation
15	Item 18	I have the requisite technical design skills for developing the latest in my field	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
16	Item 19	I keep learning new technologies	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
17	Item 20	I keep acquiring new skill-sets that will help me become more innovative	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
18	Item 21	I keep researching industry trends to stay ahead of the curve	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
19	Item 22	I frequently improvise methods for solving a problem when an answer is not apparent	1	1	0	0	1	0	1	0	1	1	10	6	4	No	0.6	0.205078125	0.49680589	Fair
20	Item 23	To compete with my fellow colleagues, I keep thinking about innovative ways of doing work	0	1	0	1	1	1	1	1	1	1	10	8	2	No	0.8	0.043945313	0.79080694	Excellent
21	Item 24	I am constantly thinking about new product or services that serve future needs	1	1	0	1	0	1	1	1	1	1	10	8	2	No	0.8	0.043945313	0.79080694	Excellent
22	Item 26	I am recognised for being at the leading edge of technological innovation	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
23	Item 27	I am the first one who brings new ideas towards product and services	1	1	1	1	1	1	0	1	1	1	10	9	1	No	0.9	0.009765625	0.89901380	Excellent
24	Item 28	I often discuss new ways of doing things with my leader	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent
25	Item 29	I am challenged by unanswered questions	1	1	1	1	1	1	1	1	1	1	10	10	0	Yes	1	0.000976563	1	Excellent

(*continued*)

Table A1

S. No.	Item code	Items	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	N	A	N	A	UA	I-CVI	Pc	κ^{*}	Interpretation
26	Item 30	I am challenged by ambiguities	1	1	1	1	1	1	1	1	1	1	10	10	0		Yes	1	0.000976563	1	Excellent
27	Item 32	I often search for new solutions to the problems that arise	1	1	1	0	1	1	0	1	1	1	10	8	2		No	0.8	0.043945313	0.79080694	Excellent
																	15	24.4			
		Total no of items																			27
		S-CVI/Ave (through ICVI)																			0.9037
		S-CVI/UA																			0.55

Notes: Items retained for data collection based on I-CVI (>0.78), κ^{*} (≥ 0.75), interpretation (excellent) and S-CVI value (>0.9); n = total number of experts. A = number of experts in agreement for a specific item. N A = difference between the total number of experts (N) and the number of experts in agreement (A). UA = universal agreement – items that gained consensus with a relevance rating of 3 or 4 from all experts. I-CVI: item-level content validity index – calculated by dividing the number of experts in agreement by the total number of experts for each item. Pc: probability of chance agreement – the likelihood that the agreement among experts occurred merely by chance. κ^{*} = modified kappa – a statistical measure used to adjust for the possibility of chance agreement among the experts. S-CVI/Ave = scale-level content validity index (average method) – computed by taking the average of I-CVI scores for all items. S-CVI/UA = scale-level content validity index (universal agreement method) – determined by the proportion of items that received universal agreement from experts

Source: Created by authors

Table A2 Sample demographics

Demographic variables	Study 2 (n = 106) Actual	%	Study 3 and 4 (n = 671) Actual	%	Study 5 Italy (n = 157) Actual	%	Study 5 India (n = 238) Actual	%
Age (in years)								
Below 25 years	6	5.7	62	9.2	8	5.1	38	16.0
26–30	17	16.0	101	15.1	19	12.1	70	29.4
31–35	19	17.9	110	16.4	26	16.6	36	15.1
36–40	23	21.7	129	19.2	28	17.8	29	12.2
41–45	16	15.1	90	13.4	17	10.8	19	8.0
46–50	10	9.4	72	10.7	25	15.9	16	6.7
51 and above	15	14.2	107	15.9	34	21.7	30	12.6
Gender								
Female	53	50.0	354	52.8	61	38.9	111	46.6
Male	53	50.0	317	47.2	96	61.1	127	53.4
Country of residence								
Italy	–	–	–	–	157	100.0	–	–
Poland	106	100.0	671	100.0	–	–	–	–
India	–	–	–	–	–	–	238	100.0
Level of management								
Middle level Managers	81	76.4	495	73.8	112	71.3	181	76.1
Top Level Managers	25	23.6	176	26.2	45	28.7	57	23.9
Total job experience								
1–5 years	31	29.2	151	22.5	34	21.7	71	29.8
6–10 years	25	23.6	183	27.3	37	23.6	76	31.9
11–15 years	18	17.0	104	15.5	21	13.4	36	15.1
16–20 years	13	12.3	67	10.0	22	14.0	18	7.6
More than 20 years	19	17.9	166	24.7	43	27.4	37	15.5
Sector of employment								
Consulting	18	17.0	98	14.6	29	18.5	22	9.2
Education	20	18.9	107	15.9	22	14.0	40	16.8
IT	19	17.9	104	15.5	51	32.5	76	31.9
Marketing and advertising	6	5.7	60	8.9	16	10.2	17	7.1
Health care	9	8.5	69	10.3	14	8.9	16	6.7
Manufacturing	34	32.1	233	34.7	25	15.9	67	28.2

Source: Created by authors

Table A3 Cross loadings

Indicators	*AO*	*CO*	*FMO*	*LO*	*TO*
IO_AO_1	0.922	0.61	0.554	0.539	0.511
IO_AO_2	0.918	0.603	0.498	0.549	0.465
IO_CO_1	0.568	0.774	0.468	0.615	0.488
IO_CO_2	0.554	0.854	0.51	0.607	0.528
IO_CO_3	0.558	0.832	0.553	0.645	0.53
IO_CO_4	0.596	0.858	0.505	0.658	0.572
IO_CO_5	0.515	0.833	0.461	0.598	0.577
IO_CO_6	0.519	0.848	0.586	0.734	0.578
IO_CO_7	0.542	0.837	0.505	0.621	0.609
IO_FMO_1	0.433	0.509	0.895	0.654	0.509
IO_FMO_2	0.547	0.579	0.898	0.641	0.554
IO_FMO_3	0.532	0.539	0.853	0.603	0.533
IO_LO_1	0.496	0.662	0.583	0.869	0.547
IO_LO_2	0.547	0.706	0.554	0.871	0.521
IO_LO_3	0.495	0.613	0.682	0.822	0.517
IO_LO_4	0.483	0.647	0.637	0.858	0.549
IO_TO_2	0.465	0.596	0.555	0.583	0.869
IO_TO_3	0.432	0.526	0.461	0.466	0.822

Source: Created by authors