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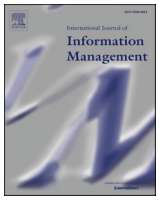

Research article

Tacit knowledge acquisition & sharing, and its influence on innovations: A Polish/US cross-country study

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ABSTRACT

This study measures the relationship between tacit knowledge sharing and innovation in the Polish (n = 350) and US (n = 379) IT industries. Conceptually, the study identifies the potential sources of tacit knowledge development by individuals. That is, the study examines how "learning by doing" and "learning by interaction" lead to a willingness to share knowledge and, as a consequence, to support process and product/service innovation. This study empirically demonstrates that tacit knowledge internalization and externalization (awareness and sharing) significantly mediate between tacit knowledge experimentation and socialization (acquisition) and its final combination (knowledge in action). While such theoretical assumptions already exist, they have not yet been empirically explained and revealed in a single structural model. Further, this empirical approach enabled a demonstration that internalization and externalization of tacit knowledge may occur consciously or unconsciously with equal success. Even so, the study also showed conscious tacit knowledge's greater impact on innovation. Therefore, an organizational effort to manage autonomous, informal, and strongly contextual tacit knowledge is worthwhile and creates the capacity for superior competitive advantage. Finally, this study also demonstrates that national context influences tacit knowledge acquisition. In the US, "learning by doing" is dominant, whereas in Poland, "learning by interaction" and critical thinking are more common. This might be related to factors such as risk acceptance that could be studied in more detail and provide opportunities for future research.

1. Introduction

The knowledge-based view of the firm is an extension of resource-based theory (Amit & Schoemaker, 1993) and posits that knowledge is the critical source for competitive advantage creation today. If so, the central function of organizations is to capture and leverage this knowledge (Garcia-Perez, Ghio, Occhipinti, & Verona, 2020). Following the theory of dynamic knowledge creation (Nonaka, 1994) based on the idea that all knowledge is rooted in tacit knowledge (Polanyi, 1966), this study aims to reveal that tacit knowledge acquisition is a critical organizational process for innovativeness. From there, it follows that tacit knowledge acquisition capacity at the organizational level is a direct, undeniable, and crucial competency determining competitive advantage creation. From this perspective, the central purpose of a learning organization, especially if interested in innovativeness, should be tacit knowledge acquisition. Theoretically, we can assume this is true based broadly on absorptive capacity (Avila, 2022; Bhadauria & Singh, 2022; Naqshbandi & Jasimuddin, 2022), a competency seen as an organization's ability to assimilate new knowledge and innovate (Bozic & Dimovski, 2019; Cohen & Levinthal, 1990; Li, Liu, Ren, & Gong, 2022; Zahra & George, 2002). Absorptive capacity mediates between knowledge acquisition and organizational innovation capability (Liao et al., 2009; Liao et al., 2007) and is determined by the existing knowledge base and its ability to incorporate knowledge (Camisón & Forés, 2010). Furthermore, the critical bottlenecks in building knowledge-based advantage are the knowledge elicitation processes concerning acquiring and transferring individuals' new abstract knowledge to an explicit form ready for organizational use (Edwards, 2022; Vásquez-Bravo, Sánchez-Segura, Medina-Domínguez, & Amescua, 2014). Even so, tacit knowledge acquisition and sharing are often seen as ambiguous and problematic, without strong empirical support (Wei, Atalag & Day, 2019). Most tacit knowledge studies regarding acquisition

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are qualitative rather than quantitative (Bhadauria & Singh, 2022; Edwards, 2022; Ouédraogo & Rinfret, 2019; Thomas & Gupta, 2021; Tyagi, Cai, Yang, & Chambers, 2015; Yang & Li, 2021). Empirical evidence is lacking on how internal tacit knowledge acquisition happens in organizations and on the key antecedents for reaching tacit knowledge consciousness. Empirical support is also slim on how individuals transform tacit knowledge into innovative solutions through semi-formal or informal social processes (Edwards, 2022; Thomas & Gupta, 2021). This study aims to deliver such empirical support, justifying the shift of tacit knowledge acquisition among workmates from a peripheral to a focal process in innovative IT organizations.

To do so, this study starts with a literature review (Section 2). Next, Section 3 considers the theoretical concepts surrounding tacit knowledge acquisition in IT, both generally and in specific areas of IT. The methodology is then presented in Section 4. Section 5 is devoted to analysis and results. The discussion continues with a deeper discussion of results in Section 6, including an explanation of the critical thinking control variable and the proposed mediation analysis. Finally, this section closes the discussion by presenting the theoretical and managerial implications as well as the study limitations and suggestions for future research. The final Section 7 presents a summary of all the formulated conclusions.

2. Literature review

As mentioned in the introduction, the knowledge-based view of the firm extends the resource-based theory (Amit & Schoemaker, 1993). It posits that knowledge is the critical source for competitive advantage creation today and that the central function of organizations is to capture and leverage this knowledge (Garcia-Perez et al., 2020). Furthermore, all knowledge is rooted in tacit knowledge (Polanyi, 1966). Therefore, tacit knowledge acquisition, discovery, distribution, and application are vital for organizational knowledge integration and use. Knowledge integration, in essence, is the capability to acquire, collect, and process the distinctive stocks of organizational knowledge central to innovation (Acharaya, Ojha, Gokhale, & Patel, 2022).

Tacit knowledge has been a core idea in the realm of knowledge management and related disciplines (sociology, psychology) since its beginning. Evolving out of sociology (Polanyi, 1966), the differentiation between explicit and tacit knowledge was fundamental to understanding knowledge assets in organizations. Nonaka and Takeuchi (1995) focused on this distinction, contrasting codifiable, explainable explicit knowledge with hard-to-express, hard-to-share tacit knowledge. The opaque nature of tacit knowledge is reflected in its scholarship. Research has explored both its nature and its sources. Given its more subjective, unstructured nature, some research has proposed that tacit knowledge is based more on personal than communal experience and reflection (Hau & Evangelista, 2007). Alternatively, to the extent that tacit knowledge can be shared with others, individuals must also be able to acquire such knowledge through interaction (Insch, McIntyre, & Dawley, 2008), although perhaps not as much through structured mechanisms or formal training programs as might be the case with explicit knowledge acquisition.

Given that difficulty in defining tacit knowledge, the challenges in capturing how it is acquired and shared are not surprising (Gupta & Thomas, 2019). As stated, a great deal of the research on tacit knowledge has been qualitative, often through case studies (Thomas & Gupta, 2021), which are challenging to extend but extremely useful for understanding situational details about its nature and about facilitating its flow (Garcia-Perez et al., 2020; Thomas & Gupta, 2021). Significant research on explicit knowledge also uses qualitative approaches and specific examples; however, research on explicit knowledge has been able to include more quantitative empirical approaches than tacit. Because it is often more structured and formalized, explicit knowledge levels can be estimated by indicators such as education levels or training hours. Unequivocal indicators for tacit knowledge are harder to identify. Furthermore, explicit knowledge is fairly well-defined and understood by users, and the most effective methods of its acquisition and sharing are well-known (Chierici, Mazzucchelli, Garcia-Perez, & Vrontis, 2019; Del Giudice & Della Peruta, 2016; Gavrilova & Andreeva, 2012; Mehreen, Rammal, Pereira, & Del Giudice, 2021). Unlike explicit knowledge, understanding tacit knowledge acquisition is a more significant challenge because of its less defined and abstract nature (Thomas & Gupta, 2021) and reliance on hard-to-define concepts such as intuition (Dorfler & Ackermann, 2015). While the details of tacit knowledge may be fuzzy and hard to communicate, the concept of tacit knowledge itself can be explained quite readily, and it is also readily accepted as a phenomenon partly because people recognize the idea from their own real-world experience. So, in this context, Polanyi's (1966) sentence describing tacit knowledge's nature, "we know more than we can tell," is familiar to many managers and workers.

Even so, from its beginnings (Polanyi, 1966), the concept of tacit knowledge has been difficult to define because of its abstract and unstructured nature. While examples and anecdotes can help to illustrate how tacit knowledge is different from explicit knowledge, further amplification has not been a smooth process. This is particularly true if the discussion is taken out of an either/or context and is viewed as more of a continuum, with a specific, contextual piece of knowledge being often more tacit or more explicit (Bunjak, Bruch, & Ćerne, 2022; Ryan & O'Connor, 2013). This view of tacit and explicit knowledge differentiation aligns well with the data–information–knowledge–wisdom hierarchy of Ackoff (1989) where knowledge acquisition ranges from structured, objective data to information, and then to knowledge, and then to unstructured, subjective wisdom. A more recent attempt of knowledge categorization and compilation within the decision-making process is the Cynefin framework (Kurtz & Snowden, 2003), which focuses on environments in which intangible assets and/or peripheral sharing are central. Based on these environmental circumstances, the continuum can be revised as data/information, explicit knowledge, tacit knowledge, and insight/intelligence (Rothberg & Erickson, 2017). This conceptualization of the knowledge acquisition continuum is in line with Wagner and Sternberg (1985), who consider tacit knowledge to be an aspect of practical intelligence (i.e., knowledge "in use" or "in action"). Tacit knowledge, unstructured and a peripheral entity more easily shared person-to-person than through centralized systems, is more difficult to both define and manage. As knowledge grows more structured and easily shared through centralized systems, as with explicit knowledge, the tasks grow easier.

Tacit knowledge refers to the accumulated skills and know-how gathered through personal experience by a particular individual (Reed & DeFillippi, 1990) and internalized through critical understanding and practice (Oliva, 2014). Therefore, this study aims to quantitatively explore the antecedents that are essential in enabling an individual to reach tacit knowledge consciousness and transform this knowledge into innovative solutions. Specifically, the study empirically links organizational tacit knowledge acquisition mechanisms with tacit knowledge sharing, then tests its influence on innovativeness (internal and external), a source of competitive advantage (Ganguly, Talukdar, & Chatterjee, 2019). Such empirical exploration is needed to better understand tacit knowledge acquisition while inspiring a deeper scientific discussion about and understanding of a problematic but focal innovation issue (Akhavan, Shahabipour, & Hosnavi, 2018; Asher & Popper, 2019, 2021).

Therefore, this study explores how tacit knowledge develops within individuals in organizations until they are willing and able to share the knowledge. The study also examines tacit knowledge acquisition methods and their influence on perceived organizational innovation. The following specific questions were formulated to guide the study's focus on understanding how the source of tacit knowledge acquisition influences its sharing and whether "learning by doing" or "learning by interaction" has a greater effect on innovativeness in the IT sector. Once the individual is conscious of tacit knowledge, does awareness drive the

confidence and willingness to share it with others? Further, does critical thinking, as a control variable, influence this development of the knowledge? What is the effect of tacit knowledge sharing on the relationship between internal and external innovation in the context of IT? Is this relation direct or mediated? Finally, do these relationships differ by country? Tacit knowledge is contextual; therefore, the national cultural context might be an important factor that should be considered in tacit knowledge acquisition studies (Kucharska, 2021a, 2021b, 2021c).

All the hypothesized relationships can be empirically evaluated by using structural equation modeling. Further, by conducting the research across two dissimilar countries—Poland and the US—this study brings a rarely employed approach to tacit knowledge acquisition studies but one that offers important opportunities for understanding tacit knowledge influence on innovativeness in different contexts of culture and economic maturity contexts.

IT is one of the most innovative sectors worldwide, with strong competitive pressure for technological and managerial innovation (Jiang & Xu, 2020). Therefore, this study selected to survey IT professionals in Poland and in the US to provide quantitative empirical data on the sources of tacit knowledge.

3. Theoretical framework

The starting point is understanding how tacit knowledge is created in organizations. Unlike explicit knowledge, tacit knowledge can be difficult to recognize, define, and express because it may be acquired unconsciously (Crane & Bontis, 2014). This aspect of tacit knowledge makes acquiring and extracting it quite challenging (Ranucci & Souder, 2015). The literature demonstrates a reasonable understanding of tacit knowledge acquisition (e.g., Akhavan et al., 2018; Asher & Popper, 2019, 2021; Garcia-Almeida & Ballesteros-Rodríguez, 2018; Kaaronen, 2018; Mulder & Whiteley, 2007; Olaisen & Revang, 2018; Sanderson, 2001; Silva & Rosemann, 2012; Thomas & Gupta, 2021; Yang & Li, 2021). Most existing studies exploring tacit knowledge capture, however, are more conceptual than empirical, and are often based on limited investigations including case studies or a single sample. Part of the reason for this may be the vagueness of tacit knowledge acquisition itself as it is difficult to understand, challenging to explain to others, strongly contextual, and therefore difficult to codify (Borges, 2012). Tacit knowledge can be grasped intuitively from experience, however, and raised to consciousness through critical thinking (Polanyi, 1966). Given tacit knowledge's more individual acquisition, its study naturally lends itself to more qualitative approaches. The advantage of qualitative studies is the potential for deep understanding of these challenging mechanisms. The advantage of quantitative analysis is its objectivity, accuracy, and extendibility. Based on considerably larger samples (Chen, 2007), conclusions in quantitative studies are formulated often based on a statistically significant number of cases rather than only a few. By employing a quantitative, instead of qualitative, approach, this study allows verification of theoretical assumptions from earlier studies (mostly qualitative). The proposed approach is novel in quantifying tacit knowledge and its context, extending previous qualitative findings. By delivering empirical evidence, this study can provide support for the relative value of "'learning by doing"' and "'learning by interaction"' processes in tacit knowledge acquisition. Empirical results also lend support to the concepts of internalization and externalization as well as their joint relationship (knowledge in action) in generating innovative solutions (internal and external).

As stated above, distinguishing between explicit and tacit knowledge is important for leveraging knowledge assets. Explicit knowledge is more amenable to being captured by the organization and then shared through formal processes and procedures and/or IT (Matson, Patiath, & Shavers, 2003; Thomas, Kellogg, & Erickson, 2001). Tacit knowledge, however, is more difficult to identify and formalize and is more likely to be managed in person-to-person situations, such as through apprenticeships, mentoring, and/or communities of practice (Brown & Duguid, 1991; Khuzaimah & Hassan, 2012). As noted, tacit knowledge is typically modeled as having progressive layers of development (Olaisen & Revang, 2018), and there are continuing questions about the empirical demonstration of these layers such as tacit knowledge internalization and externalization (awareness and sharing), experimentation and socialization (acquisition) and its final combination (knowledge in action). This study empirically explores the meaning of particular methods of tacit knowledge acquisition for organizational innovativeness.

The overall view of tacit knowledge developed in this paper is from the perspective of the acquisition of this type of knowledge influencing a firm's innovation performance. This perspective requires framing. This section focuses on the general concept of tacit knowledge before the following sections discuss specific aspects in more detail.

3.1. Tacit knowledge acquisition

According to Bennet and Bennet (2008a), tacit knowledge often dwells beyond ordinary consciousness. If the employee's tacit knowledge shifts to a more conscious level, it enhances the organization's capacity to learn from it (Bennet & Bennet, 2008b). So, in this context, tacit knowledge awareness is the moment when tacit knowledge is shifted from the unconscious to the conscious level. Technically, it is the "ba" moment (El-Den & Sriratanaviriyakul, 2019; Tyagi et al., 2015), when new ideas, skills, and intuitive knowledge from experiences become conscious enough to be somehow shared (e.g., demonstrated, contextually told) with others.

Tacit knowledge acquisition generally occurs through subsidiary awareness (Tsoukas, 2003). That is a basis for unconscious learning through firsthand experience or person-to-person sharing, referred to as either "learning by doing" or "learning by interacting" (Eraut, 2000; Muñoz, Mosey, & Binks, 2015). This type of learning depends on the personal abilities of the individual (Gascoigne & Thornton, 2013) such as intelligence level or educational background; external conditions facilitating knowledge acquisition such as company culture (Kucharska, 2021b); and the situational context. Situational context triggers tacit knowledge disclosure. To be successful in tacit knowledge acquisition, organizations should consider all these conditions while focusing carefully on creating situational opportunities for tacit knowledge capture. Asher and Popper (2021) presented a review of existing methodologies to elicit tacit knowledge in organizations. Following El-Den and Sriratanaviriyakul (2019), Gavrilova and Andreeva (2012), Hao, Zaho, Yan and Wang (2017), and Hoffman, Shadbolt., Burton and Klein (1995), these researchers identified techniques enabling tacit knowledge revelation such as brainstorming, thinking aloud, opinion giving, storytelling, concept mapping, scenario-based analysis, reflective interviews, and case studies that can be grouped as "social interactions." Moreover, Bandura's (1971) social learning theory directly states that people learn thanks to social interaction. Therefore, the following hypothesis is proposed:

H1a. . "Learning by interaction" is directly and positively associated with tacit knowledge awareness.

The main organizational mechanisms of tacit knowledge capture are both individual and shared-learning experiences (Nelson & Winter, 1985) or experiments (Ranft, 1997). Suppose the team shares these, then internalization and externalization are both probably easier (but the group must understand the meaning of "what happened"). If these experiences are individual, the learner must be conscious of what was learned to share it consciously ("ba" moment). Based on their comprehensive literature review, Asher and Popper (2021) emphasized that tacit knowledge can be elicited at work because of the combination of formal and informal knowledge exchange and practice. And they stressed that interpersonal interactions foster such knowledge sharing (revelation). Bryans (2017) noted that 80% of employee learning occurs informally and is entirely unplanned, incidental, and mainly experiential. Consequently, most organizational learning is highly personal, and

personal discoveries are tacit. On the other hand, tacit knowledge acquisition can also come from experiences, e.g., simulation, observation, and experimentation, and can be grouped as "learning by doing" acquisition methods. Numerous previous studies suggest that "learning by doing" leads to the self-recognition of new knowledge (Insch et al., 2008; Zou & Lee, 2016). Also, Eraut (2000), McLeod et al. (2006), and Olaisen and Revang (2018) demonstrated that next to "learning by interaction", "learning by doing" is the primary source of tacit knowledge acquisition, leading to the following hypothesis:

H1b. . "Learning by doing" is directly and positively associated with tacit knowledge awareness.

Relatedly, there has also been a sense that tacit knowledge is more practical than theoretical, originating in activities rather than in theory (Sternberg, Wagner, Williams, & Horvath, 1995). To the extent that tacit knowledge is grounded in experience, scholars have proposed different versions of how it grows (Chen, Baptista Nunes, Ragsdell, & An, 2018). Nonaka (1994) suggested there is a cognitive component including the experiential inputs needed and a technical component including the learning skills required: for application preparation (cognitive component) and execution (technical component). A more recent extension of this proposal includes an effectuation component, referring to the individual realizing they know something valuable (Jisr & Maamari, 2017), leading to socialization and sharing. Moreover, social interaction might logically inspire experimentation. More specifically, thanks to a "shared common vision" (Senge, 1992; Xiao & Jin, 2010), organizational flexibility, and freedom in acting, behaviors such as improvising or experimenting (Ambituuni, Azizsafaei, & Keegan, 2021) can be excellent opportunities for tacit knowledge acquisition by "learning by doing". The literature above also provides some evidence that "learning by interaction" can engender knowledge recognition from former experiences (Brachos, Kostopolous, Soderquist, & Prastacos, 2007; Leonard & Insch, 2005; Oswald & Mascarenhas, 2019; Vick, Nagano, & Popadiuk, 2015). Consequently, the second hypothesis, which is complementary to the first, is:

H2. . "Learning by interaction" is directly and positively associated with "learning by doing".

3.2. Tacit knowledge discovery

The discussion so far has defined tacit knowledge as having specific levels of awareness, application, and social interaction, suggesting differing degrees of tacitness. Moving to more recent conceptualizations, Asher and Popper's (2019) "onion" model posits different layers of tacit knowledge and a description of knowledge as a matter of degree along a single axis, where knowledge is more explicit at one end and moves toward being more tacit at the other end, with elements of both existing in the middle. From this perspective, tacit knowledge has three aspects: a hidden practical layer, a reflective tacit layer, and a demonstrated tacit layer. These layers range from being easier to explain and closer to explicit knowledge to being virtually impossible to explain and only demonstrable at the furthest reaches of tacit knowledge, perhaps verging on the insight/intelligence concept developed in the fuller discussion on all intangible assets (e.g., Rothberg & Erickson, 2017; Rothberg & Erickson, 2007).

Similarly, Olaisen and Revang (2018) argue for a three-level model, including representable knowing, non-represented knowing, and non-representable knowing. Again, representable knowing can be explained and is at the explicit end of knowledge, although it requires some degree of tacit interpretation for the actual application. Non-represented knowing is tacit knowledge that is not yet explicit but could be explicit. Issues of individual knowing versus organizational knowing are also explored by, for example, Asher & Popper (2019), raising the question of whether the knowledge can be shared and whether individuals are willing to share it (Park, Chae, & Choi, 2017). Olaisen and Revang's (2018) conclusion of best options for tacit knowledge sharing is based on an in-depth case study of a furniture manufacturer, and it argues that all forms have the potential to be shared across the collective work; however, recognition of the tacitness and the use of appropriate techniques (e.g., observation) are important in achieving its awareness. A more quantitative research approach could support these theoretical insights. Therefore, our model focuses on tacit knowledge at the stage when the knowledge can be recognized and then shared. Specifically, we argue that as individuals become aware of having learned something, they reflect upon it and reduce it to a form that can be communicated and shared.

The natural question arising from the proposed model is what allows individuals to move through all tacit knowledge stages to achieve the conscious level. The literature that has been reviewed (Oswald & Mascarenhas, 2019; Van Braak, De Groot, Veen, Welink, & Giroldi, 2018; Venkatesh & Ma, 2021; Wipawayangkool & Teng, 2016a, 2016b) noted how internalization can occur and how the individual can reflect upon what they are doing and/or what they know. With internalization comes self-efficacy and expert power (Wipawayangkool & Teng, 2016a, 2016b), building confidence in the value of the knowledge and the user's ability to judge when to apply it. This reflection and resulting depth of understanding can be characterized as critical thinking (Oswald & Mascarenhas, 2019). Given that the reflection process enables individuals to identify new meaning from interactions or behaviors (Van Braak et al., 2018; Venkatesh & Ma, 2021), critical thinking may be an extraneous variable influencing both tacit awareness and tacit sharing. To better understand the link between tacit knowledge awareness and tacit knowledge sharing, this study explicitly investigates the direct connection between awareness and sharing as well as the potential intervening mechanism of critical thinking as a control variable.

A control variable is an additional factor that possibly influences the relationship between an independent and a dependent variable and may act as a confounder, moderator, or suppressor (Spector & Brannick, 2011). The methodology of imputing a control variable enables this extraneous variable to be included in the model and remain theoretically important, even when the variable is not the focal point of the study. In addition, such imputation should be justified through additional hypotheses (Becker et al., 2016). For this study, critical thinking is one such theoretically important variable. All experience gained must be facilitated by critical thinking to create new knowledge (Oswald & Mascarenhas, 2019). Self-reflection on the tacit knowledge derived from interactions or behaviors may increase awareness of the tacit knowledge. As discussed above, some tacit knowledge is gained by learning through hands-on experience. Reflection on those lessons learned can lead to knowledge recognition. Therefore, the following hypothesis is proposed:

Hcv1a. . Critical thinking moderates the "learning by doing" and tacit knowledge awareness relationship.

The literature covered above also demonstrated that tacit knowledge can come from learning from others, from direct interaction. As just noted, new meaning derived from knowledge can occur whether the knowledge comes from interpersonal sharing or direct experience (Van Braak et al., 2018; Venkatesh & Ma, 2021). Social conditions within the organization can encourage development through interactions (Senge, 1992; Xiao & Jin, 2010). Once available, tacit knowledge obtained through sharing can also be subject to reflection. Thus, critical thinking may also have a role in the development of not just "learning by doing" tacit knowledge but also "learning by interaction". Reflection on lessons learned from co-workers and others can also lead to knowledge recognition.

Hcv1b. . Critical thinking moderates the "learning by interaction" and tacit knowledge awareness relationship.

Critical thinking may also create self-efficacy and confidence that can lead to more sharing. When confident of adding value, based on

reflection, individuals may be more inclined to share newly discovered knowledge. Social exchange theory holds that employees weigh the potential benefits and risks that can come from sharing (Hoksbergen, Chan, Peko, & Sundaram, 2021; Jiang & Xu, 2020; Yan, Wang, Chen, & Zhang, 2016). Sometimes, they simply decide to hide knowledge (Connelly, Cerne, Dysvik, & Skerlavaj, 2019). This weighing of potential benefit and risk occurs through critical thinking. Therefore, the following hypothesis is proposed:

Hcv2. : Critical thinking moderates the tacit knowledge awareness and sharing relationship.

3.3. Tacit knowledge sharing

Individuals possessing valuable tacit knowledge, particularly if they recognize they have such knowledge, need to be willing to share it if the firm is to fully benefit. Prior research has clarified several details concerning circumstances of sharing (e.g., Akhavan et al., 2018; Asher & Popper, 2019, 2021; El-Den & Sriratanaviriyakul, 2019; Jiang & Xu, 2020; Thomas & Gupta, 2021). From one perspective, individual characteristics engender tacit development. Knowledge workers not only develop deeper tacit understanding, ranging from situational (context-specific) solutions to standardized response (repeated) solutions to intuitive insights (Eraut, 2000), but also gain more confidence in the effectiveness of their knowledge. As individuals internalize their tacit learning, they gain both self-efficacy and a sense of expert power (Wipawayangkool & Teng, 2016a, 2016b). This confidence in their own knowledge and usefulness, combined with the recognition of fit to a given situation, can lead to more willingness to apply their knowledge and/or share it with others. Individual willingness is vital in such sharing because sharing is an informal, voluntary act (Kucharska, 2021b). Senses of internal control (self-confidence) and external control (influence results) combined with strong social capital can influence the intention to share knowledge and push the individual toward completion (Göksel & Aydintan, 2017). In more practical terms, individuals will share rather than hoard knowledge when they are confident in what they know, that the knowledge will contribute to the organization's value production. Both self-confidence and organizational acceptance can be important to take full advantage of tacit knowledge discovery.

A related issue is the source of the tacit knowledge because the source may influence knowledge awareness and sharing intention. As noted, tacit knowledge is viewed as knowledge that comes from practical experience; it is something recognized and then applied, but it could come from individual experience or from another sharing their experience. Tacit knowledge can be acquired firsthand through experience over time or more quickly from someone communicating and/or demonstrating knowledge person-to-person. The knowledge source has the potential to affect both the recognition and explicability of tacit knowledge as well as the user's willingness and confidence to share the knowledge.

In relation to the present study, once the precursors for the hypothesized model are in place, the theorized relationships developed in the previous section can be explored. Specifically, it must be considered whether individuals becoming aware of their tacit knowledge makes them more likely to participate in knowledge sharing in the organization. Based on the ontological model of Chergui, Zidat, and Marir (2020), this would be the case. Confidence in understanding and belief in the benefits to others of tacit knowledge may lead to more sharing behavior. As discussed, internalization and self-efficacy make sharing more likely and can be tied to tacit knowledge awareness. Kucharska (2021c), based on the IT, construction, and healthcare industries, empirically demonstrated that tacit knowledge awareness fosters tacit knowledge sharing. Thus, the following hypothesis is proposed:

H3. . Tacit knowledge awareness directly and positively influences tacit knowledge sharing.

3.4. Tacit knowledge in Use (in action)

Once tacit knowledge is acquired and recognized by the individual, it can be applied to their work and/or shared with others. The underlying justification for interest in managing this type of knowledge is the effect it has on organizational performance. This effect could be operational (e.g., efficiency, quality); financial (e.g., profitability, return on investment); or some other desired outcome (e.g., competitiveness). One common indicator of "tacit knowledge in action" is improved innovation performance. As noted, tacit knowledge is located on the wisdom/insight end of the intangibles continuum (constant, creative ideas developed through critical thinking), and it seems more likely that tacit knowledge would generate more innovative ideas than would explicit knowledge or data/information, which are located on the incremental end of this continuum (Islam & Chadee, 2021; Kucharska, 2021a, 2021b; Rothberg & Erickson, 2017). Indeed, Liu and Han (2012), specifically associate tacit knowledge with creativity in innovation processes. Similarly, the empirical relationship between tacit knowledge and "fuzzy front end" breakthrough ideas emphasizes the role of sharing through tacit techniques such as stories and metaphor (Sakellariou, Karantinou, & Goffin, 2017). Considering a precise set of circumstances (i.e., foreign-sourced tacit knowledge), Sheng (2019) demonstrated that under the right conditions, tacit knowledge contributes to product innovation. In addition, Ganguly et al. (2019) recently brought together some of the tacit characteristics that have been discussed here, including knowledge quality and knowledge sharing, and demonstrated a connection between these factors and innovation capabilities.

As with other concepts discussed in this paper, innovation can be viewed in a number of ways, with product versus process innovation being a common perspective (Eidizadeh, Salehzadeh, & Esfahami, 2017; Jimenez-Jimenez & Sanz-Valle, 2011; Jimenez-Jimenez, Sanz-Valle, & Hernandez-Espallardo, 2008; Manu, 1992).

Product innovation refers to the development and introduction of new products, both goods and services. For clarity in notation, this paper refers to this variable as product/service innovation. As the name suggests, process innovation is associated with operational processes and operational effectiveness, that is, the manufacturing of the good or the execution of the service. As discussed, there is a sense in the literature that effective knowledge management, particularly management of tacit knowledge, can help to generate innovation (Brachos et al., 2007; Goffin & Koners, 2011; Goffin, Koners, Baxter, & van der Hoven, 2010; Jisr & Maamari, 2017; Kodama, 2019; Sakellariou et al., 2017; Sheng, 2019). In particular, tacit knowledge, which is on the more subjective and unstructured side of intangible assets, may be particularly linked with the customer-facing product and service innovation (Kucharska, 2021a). Therefore, the following hypothesis is proposed:

H4. . Tacit knowledge sharing directly and positively influences product/service innovation.

Tacit knowledge is also linked with incremental, process-based improvements that concern everyday operations at work. From an employee's perspective, these may be improvements in working methods experienced firsthand (Kucharska, 2021a; Kucharska & Rebelo, 2022). Studies by Al-Husseini and Elbeltagi (2016) stressed innovation differences for processes (methods of work) and products (effects of work), and, recently, Bulut, Kaya, Mehta, and Danish (2022) followed them. Thus, the hypothesis is proposed as below:

H5. . Tacit knowledge sharing directly and positively influences process innovation (internal).

Either type of innovation is possible, but the more incremental innovations often seen in process innovation may lead to more substantive product/service innovations. In addition, an accumulation of improvements in operational processes can also lead to new products and services (Kucharska, 2021a, 2021b; Kucharska & Rebelo, 2022). Furthermore, Hagedoorn and Wang (2012) showed that a dependency

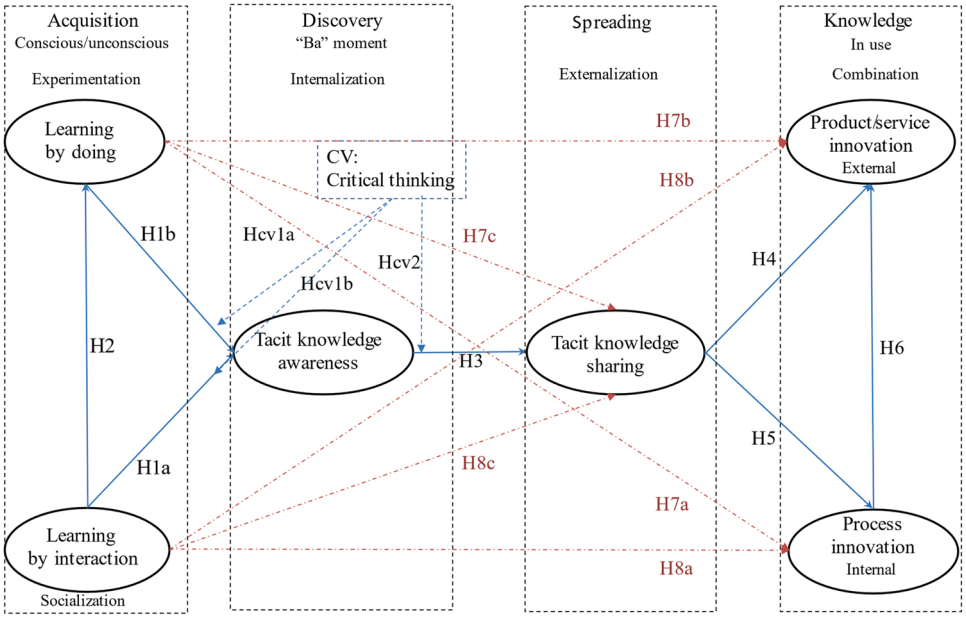

Fig. 1. Theoretical Model.

exists between internal and external innovativeness. Also, Wong and Chin (2007) noted that improvement in internal processes might increase the overall innovativeness of the company. Therefore, internal innovations may significantly support external innovations. Thus, the following hypothesis was formulated:

H6. . Process innovation directly and positively influences product or service innovation (external).

3.5. Alternative model

To explore more deeply the value of all tacit knowledge transformation stages—socialization, experimentation, externalization, and combination (Chergui et al., 2020; Philipson & Kjellström, 2020)—to innovativeness (Ganguly et al., 2019; Pérez-Luño Alegre, & Valle-Cabrera, 2019; Sikombe & Phiri, 2019), we include an alternative model expanding the basic model. The following hypotheses directly link tacit knowledge acquisition methods (Asher & Popper, 2021) with internal and external innovativeness (Kucharska, 2021a, 2021b). These direct hypotheses enable precise detection of the indirect relation between tacit knowledge acquisition (socialization and experimentation) and tacit knowledge in action (combination), mediated by awareness and sharing (internalization and externalization), as theorized by Asher & Popper (2019, 2021), but not empirically tested before in a single structural model. Moreover, such empirical evidence can firmly establish how vital all these processes and their interdependence are for innovativeness.

More specifically, tacit knowledge from hands-on experience has a place in internal process innovations. Knowledge workers have a clear role in recognizing and helping to implement innovative ideas improving the processes in which they participate. While Asher & Popper's (2019, 2021) knowledge development process just mentioned may be positively impacted by tacit knowledge awareness, that doesn't mean awareness or sharing is always required for impact. Particularly in process innovation, individuals may not fully realize their learnings that have led to better performance, essentially the sometimes unconsciously acquired tacit knowledge (Crane & Bontis, 2014) or extreme version of "unrelatable" tacit knowledge (Olaisen & Revang, 2018) discussed in the literature review. Tacit knowledge acquired through experience may have a relationship with process innovation independent of knowledge awareness.

H7a. : "Learning by doing" directly and positively influences process innovation (internal).

Similarly, tacit knowledge gained from hands-on experience may also have a more immediate role in an organization developing and launching external product/service innovations (Sheng, 2019). Those sorts of new products offered to customers are obviously more apparent (suggesting the importance of awareness at some stage) but also typically have a complex innovation process. As noted in the literature review, the fuzzy front end of innovation requires creative ideas, a process not necessarily well-understood (Sakellariou, Karantinou, & Goffin, 2017). The serendipity of new product ideas can be related to tacit knowledge concepts discussed here such as intuition. Creators may recognize new ideas and be able to communicate them but explaining how the idea came about is more tacit and the process of successful idea generation can be almost impossible to share. Improvements to new product ideas throughout the development process may be similarly hard to communicate. Workers discovering new knowledge for themselves, learning by doing, have the potential to contribute to the success of commercialized new products.

H7b. : "Learning by doing" directly and positively influences product/service innovation (external).

Alternatively, tacit knowledge obtained through interactions with co-workers and others has similar potential to improve processes in which the worker participates. As with "learning by doing", that impact may happen without awareness or further sharing. The nature of tacit knowledge is such that sharing techniques include those based on a more subconscious level of understanding. Interpersonal interactions through means such as storytelling or case studies (Asher & Popper, 2021) can pass along insights without necessarily identifying or even realizing the knowledge to be exchanged. Social interaction may lead to useful tacit knowledge that may then have an impact on process innovation without further levels of knowledge development. Helping to identify and implement useful process improvements or finding new and innovative ways to apply new learnings can lead to better performing processes.

H8a. : "Learning by interaction" directly and positively influences process innovation (internal).

And, of course, tacit knowledge from interaction and sharing would then likely also be able to contribute to the creation and development of

new products. As with knowledge from experience, how to originate and improve new product ideas is fuzzy. Firms recognize that new product ideas can come from anywhere, hence the use of crowdsourcing, brainstorming, and other techniques involving cooperation and sharing. Recall than most that most employee learning is informal, unplanned, and incidental (Bryans, 2017), so the new product ideas that go into the innovation process may come from a second party, even if they don't realize they are the source of a key idea or what its full potential might be. The recipient of the knowledge may also not fully understand its value or the process by which it was generated, but the concept can still move forward into development.

H8b. : "Learning by interaction" directly and positively influences process innovation (internal).

Additionally, to expose the value of the "discovery stage" of tacit knowledge creation, the following alternative hypotheses are formulated about the direct connection between tacit knowledge acquisition methods and tacit knowledge sharing (Asher & Popper, 2019, 2021). As with the previous H7 hypotheses, the full path from knowledge acquisition through awareness and then on to sharing can aid innovation but may not always be fully necessary. Once again, the "unconscious" nature of some tacit knowledge and "unrelatable" tendencies may mean workers are unaware they possess valuable knowledge that can be shared (Crane & Bontis, 2014; Olaisen & Revang, 2018) but insights might be picked up by others simply by their own observation (further "learning by interaction") or informal chats. Tacit knowledge obtained from hands-on learning has potential to be shared, with or without tacit knowledge awareness.

H7c. : "Learning by doing" directly and positively influences tacit knowledge sharing.

Similarly, tacit knowledge from interactions with others also has the potential to be shared. Also as noted above, obtained knowledge of which the worker is aware may more effectively aid innovation through sharing, but sharing may occur even without the awareness step. Hypotheses H8a and H8b are based on how innovation can occur, even without awareness or formal sharing. So certainly if sharing does take place at acquisition, through tools such as storytelling, case studies, or other informal interchanges (Bryants, 2017; Asher & Popper, 2021), that know-how can be further shared, even without awareness. Knowledge acquired from such personal interactions could likely be spread further by similar interactions, whether or not the sharer fully realizes they hold these new insights.

H8c. : "Learning by interaction" directly and positively influences tacit knowledge sharing.

The theoretical model below (Fig. 1) summarizes the described assumptions.

3.6. Cross-country Study Justification

Given all the individual, social, and cultural aspects of developing and sharing knowledge, a frequent area of study in this field of research concerns how national differences affect knowledge management processes (Kucharska, 2021a, 2021c). This research field is the focus of some of the literature forming the basis of this study, including studies on the acquisition, recognition, and sharing of tacit knowledge (Lee, Chen, Kim, & Johnson, 2008; Sheng, 2019; Subramaniam & Venkatraman, 2001). To perform the cross-country comparison, this study includes two different samples: one from the US and one from Poland. The former is a highly developed, mature economy while the latter is fast-growing and still developing. Mercier-Laurent (2011), in the context of innovativeness, noted that such national characteristics as institutional development, infrastructure, macroeconomic conditions, healthcare, and education levels have influenced intellectual capital development. In addition, she characterized Poland as having high but not fully exploited innovative potential. Since this study focuses on tacit knowledge creation and sharing as a root of innovativeness, comparing Poland, without fully exploited innovativeness potential, with the innovativeness leader is interesting. Further, Vos and Boonstra (2022) noted that cultural context matters for entire enterprise systems, including tacit knowledge issues. Similarly, Andreeva, Garanina, Saenz, Aramburu and Kianto (2021) found that a country's environment determines its intellectual capital and innovation performance. This study follows this literature, adding empirical data verifying how tacit knowledge awareness and sharing influence innovativeness in Poland and the US. No further hypotheses are advanced, but the discussion will report the national differences in relation to the hypotheses already described.

3.7. Expected mediations

Indirect (mediated) effects are a valuable source of knowledge about the interrelationships of the variables explored in structural models (Nitzl, Roldan, & Cepeda, 2016). For all of the hypotheses and moderations presented above, expected mediations can provide a deeper understanding. As stated, tacit knowledge sources are related to metacognition and expert power (Wipawayangkool & Teng, 2016a, 2016b) as well as the cognitive and social aspects of learning environments (Insch et al., 2008). Moreover, the practical experience in a relevant (social) context (Lam, 1998) might lead to tacit knowledge acquisition. Therefore, the "learning by doing" (LD) mediation between "learning by interaction" (LI) and tacit knowledge awareness (TKA) is expected, and presented below.[1].

LI→LD→TKA.

Moreover, the relationship between tacit knowledge sharing (TKS) and external innovation (PSI) may be mediated by internal innovation (PI). This relationship flows from an expectation that an organization should improve itself internally to win the market externally. Kucharska (2021a, 2021b) findings confirm these assumptions. Specifically, she noted that internal innovations support the relation between tacit knowledge sharing and external innovations. Therefore, to explore the entire theoretical model more thoroughly, and reveal all interrelations, this proposed mediation must be included. This inclusion matters for the holistic exploration of the entire theoretical structure explored in this study. Therefore, the investigation includes the mediation.[2].

TKS→PI→PSI.

Furthermore, regarding alternative models, the study also expects additional indirect effects to be linked with the sets of alternative "direct" hypotheses (H7a, H7b, H7c; H8a, H8b, H8c). Specifically, if the direct influence of "learning by doing" and "learning by interaction" on innovativeness (internal and external) is expected, and the direct effects of these knowledge sources on tacit knowledge sharing have been justified, then it might be possible that tacit knowledge sharing mediates these relationships. This idea is in line with the literature linking tacit knowledge with innovativeness (Ganguly et al., 2019; Pérez-Luño et al., 2019; Sikombe & Phiri, 2019). Therefore, the following mediations are expected,[3,4,5 6].

[1] LI-learning by interaction; LD-learning by doing; TKA-tacit knowledge acquisition

[2] TKS- tacit knowledge sharing; PI- process innovation (internal innovations); PSI- product or service innovation (external innovations)

[3] LI-learning by interaction; TKS- tacit knowledge sharing; PI- process innovation (internal innovations)

[4] LI-learning by interaction; TKS- tacit knowledge sharing; PSI- product or service innovation (external innovations)

[5] LD-learning by doing; TKS- tacit knowledge sharing; PI- process innovation (internal innovations)

[6] LD-learning by doing; TKS- tacit knowledge sharing; PSI- product or service innovation (external innovations)

Table 1
Sample Characteristics.

Characteristic	Poland (n = 350)	USA (n = 379)
C-suite	3%	3%
Top managers	7%	7%
Middle managers	23%	23%
Professionals	67%	67%
Company size	3%	2%
Micro (<10 employees)	77%	6%
Small (10–50 employees)	11%	25%
Medium (51–250 employees)	8%	66%
Large (>250 employees)		
Age	1%	2%
18–24	19%	27%
25–34	49%	50%
35–44	21%	16%
45–54	9%	6%
55–64	2%	1%
65 and over		
Gender	50%	49%
Female	50%	50%
Male	0	1%
Other		
KMO	.838	.908
Harman single factor test	23%	33%
Total Variance Explained	65%	73%
Common Method Bias	24%	48%

Table 2
Invariance Measurement.

MCFA models	CFI	IFI	TLI	GFI	AGFI	RMSEA
Unconstrained model	.921	.939	.910	.902	.896	.050
Loading measurement equality, measurement model (Δ)	.920 (.001)	.932 (.007)	.913 (.003)	.894 (.008)	.886 (.010)	.049 (.001)
Factor covariances equality, structural model (Δ)	.918 (.002)	.922 (.010)	.915 (.002)	.880 (.014)	.871 (.015)	.049 (.000)

Note: IFI, CFI, GFI and AGFI referenced values greater than 0.90 are considered as good, greater than 0.95 as excellent; RMSEA is considered correct in the range of 0.05 to 0.08 (Hair et al., 2010; Hooper, Coughlan, & Mullen, 2008; Kline, 2005). GFI and AGFI depend on sample size and degrees of freedom. Therefore, given the often-detrimental effect of sample size on these indexes, they are not relied upon as a stand-alone index, so they should always be considered in a particular statistical context (Hooper et al., 2008). Furthermore, the RMSEA index is generally preferable for power analysis and model evaluation than GFI and AGFI values (MacCallum & Hong, 1997).

LI→TKS→PI

LI→TKS→PSI

LD→TKS→PI

LD→TKS→PSI

Similarly, studies have found that "learning by doing" and "learning by interaction" influence tacit knowledge awareness (Brachos et al., 2007; Leonard & Insch, 2005; Oswald & Mascarenhas, 2019; Vick et al., 2015; Zou & Lee, 2016). Thus, in the alternative model, where both these knowledge sources are linked directly to tacit knowledge sharing, tacit knowledge awareness might serve as a mediator,[7],[8]

LI→TKA→TKS

LD→TKA→TKS

4. Method

4.1. Samples and data collection

Scale validation requires a minimum of two separate samples (DeVellis, 2017; Meek, Ryan, Lambert, & Ogilvie, 2019) to verify the reliability and validity of the proposed scales. Accordingly, the sampling plan here included independent samples of IT professionals in Poland (n = 350) and the US (n = 379). The research design was straightforward, an ad hoc, descriptive study executed through a survey, but the conceptualization and the instrument itself were complex. With a targeted but geographically dispersed segment from a specific industry, random sampling was not an option. Accordingly, administration of the study was handed over to experienced commercial survey firms, Qualtrics in the US and ASM in Poland. These professional partners used online, panel-based quota sampling, achieving appropriate randomness in an efficient manner.

Survey execution took two months (January–February 2020). The questionnaire included filter questions to establish minimum work experience and status as a "knowledge worker." Respondents were also prompted with a short explanation of the meaning of "tacit knowledge." The core of the survey, excluding classification items, used a seven-point Likert scale to assess intensity of feeling. Data management was straightforward. Only fully completed questionnaires with SD > .4 were included.

Table 2 presents the sample characteristics. Where comparable, the sample generally matched the underlying populations (jobs, gender) of both countries (Statistics Poland, 2017; US Bureau of Labor Statistics, 2020). While some differences were apparent in the underlying populations, they were not sufficiently significant to justify varying the quota targets. Since there is a huge discrepancy in the labor market structure and size between both countries, the Polish quota structure was used as a pattern for the samples for both countries. Table 1 presents characteristics of samples employed to this study.

4.2. Measurement constructs

DeVellis (2017) states that "measurement is a fundamental activity of science" (p. 2). Social science measures focus on social constructs that are not easy to measure directly via methods such as observation. Thus, scales, which are collections of statements that reflect the meaning of a particular construct, are used to reveal unobserved social variables. However, the methodological literature warns that measurement bias might occur when statements overlap (DeVellis, 2017). Therefore, the authors proposed their own scales based on the findings and definitions in existing studies, ensuring that the statements did not overlap with one another, the proposed model measured all constructs correctly, and all the proposed relationships accurately fulfilled the study objectives. Appendix 1 presents the meanings of the constructs employed, as well as the statements measuring these constructs. Effects of the reliabilities obtained are also reported.

In summary, statements according to definitions from prior qualitative studies were first synthesized and then validated the scales

[7] LI-learning by interaction; TKA-tacit knowledge acquisition; TKS- tacit knowledge sharing

[8] LD-learning by doing; TKA-tacit knowledge acquisition; TKS- tacit knowledge sharing

Table 3
Focal Models Statistics, Correlations, and Square Root AVE—Across Industries (Poland/USA).

Construct	Mean	SD	Cronbachα	C.R.	AVE	CT	LI	LD	TKA	TKS	PI	PSI
CT	6.50/ 5.94	0,71/ 1.3	.71/.73	-	-	-						
LI	5,84/6.07	1,09/0.98	.74/.71	.76/ .75	.51/ .50	.237/.468	**.716/.705**					
LD	6.37/6.30	0,84/0.91	.74/.73	.77/ .75	.53/ .50	.403/ .402	.323/.705	**.727/.707**				
TKA	6.12/6.18	0.90/ 0.98	.76/.77	.75/ .84	.51/ .64	.349/ .413	.339/ .552	.342/ .697	**.712/.801**			
TKS	5.90/ 6.18	1,07/ 0.98	.73/.79	.76/ .79	.52/ .56	.136/ .299	.132/ 0.4	.133/ .492	.389/ .724	**.723/.748**		
PI	5.44/5.95	1,23/ 1.15	.82/.86	.83/ .86	.54/ .61	.04/ .107	.04/ .143	.04/ .176	.117/ .259	.3/ .357	**.737/ .930**	
PSI	5.60/ 5.60	1,05/ 1.12	.80/.87	.82/ .87	.53/ .62	.039/ .133	.038/ .178	.038/ .218	.112/ .322	.288/ .444	.725/ .922	**.729/.790**

*Bold indicates average variance extracted (AVE) square roots

Table 4
Relationship between Tacit Knowledge Sources, Tacit Knowledge Development, and Innovation—by Country, with and without Critical Thinking as a Control Variable: Focal and Alternative Models.

Information Technology (IT) Professionals						
Country	Poland			USA		
	Focal models		Alternative model	Focal models		Alternative model
CV critical thinking	Model A without CV	Model B with CV		Model A without CV	Model B with CV	
R^2	.53	.53	.54	.86	.86	.85
H1a	.25 * **	.23 * **	.16 *	NS	NS	NS
H1b	.26 * **	.17 *	.24 * **	.57 * **	.54 * **	.45 * **
H2	.32 * **	.35 * **	.23 * **	.70 * **	.77 * **	.77 * **
H3	.38 * **	.33 * **	.19 * *	.70 * **	.61 * **	.14 * *
H4	NS	NS	NS	.14 * **	.14 * **	NS
H5	.30 * **	.30 * **	NS	.36 * **	.36 * **	.63 *
H6	.70 * **	.70 * **	.64 * **	.86 * **	.86 * **	.85 * **
Hcv1a		.22 * **	.20 * **		.14 * *	.16 * *
Hcv1b		.27 * **	.23 * **		NS	NS
Hcv2		.14 *	NS		.19 * **	NS
H7a			.16 *			-.74 *
H7b			.14 * **			NS
H7c			.18 * *			.69 * **
H8a			.33 * **			.52 * **
H8b			NS			NS
H8c			.33 * **			NS
LI→LD→TKA	comp mediation	comp mediation	comp mediation	full mediation	full mediation	full mediation
TKS→PI→PSI	full mediation	full mediation	no mediation	comp mediation	comp mediation	full mediation
LI→TKS→PI			comp mediation			no mediation
LI→TKS→PSI			full mediation			full mediation
LD→TKS→PI			no mediation			comp
LD→TKS→PSI			comp mediation			no mediation
LI →TKA →TKS			comp mediation			full mediation
LD →TKA →TKS			comp mediation			comp mediation
χ2	358.141(163)	409.718(180)	411.75(193)	550.073(163)	558.628(179)	415.86(193)
CMIN/df	2.19	2.27	2.13	3.37	3.12	2.15
RMSEA	.059	.060	.057	.079	.075	.055
CFI	.922	.910	.919	.903	.907	.948
TLI	.909	.896	.903	.887	.891	.938

according to procedures described by DeVellis (2017). Appendix 1 presents a summary of this stage of the study—namely, the constructs to be measured, their definitions, and specific statements conceptualizing the constructs. The critical thinking variable (CT) was operationalized as a composite variable from the seven-point Likert scale and imputed as a control variable to the structural model performed by SPSS Amos. Next, the obtained positive effects on tacit knowledge awareness and sharing were analyzed in greater depth as moderators of the relationships between these variables and their predictors. Finally, these effects were visualized by applying OLS regression by SPSS PROCESS (Hayes, 2018).

4.3. Measurement metrics

In assessing sample quality, invariance was reviewed using the KMO measure of sampling adequacy (i.e., the KMO test) and Harman single factor tests. The samples come from two countries, so the invariance tests of adequacy are needed to verify that the measurement instrument operates properly across the different populations. As discussed, the scales were developed by the authors based on items and terminology from the literature (Appendix 1). Next, CFA for both samples was used to verify the scales did not overlap (Appendix 2). The Polish sample shows low correlations between the constructs and loadings, but the US sample did indeed suggest that some constructs such as internal and external

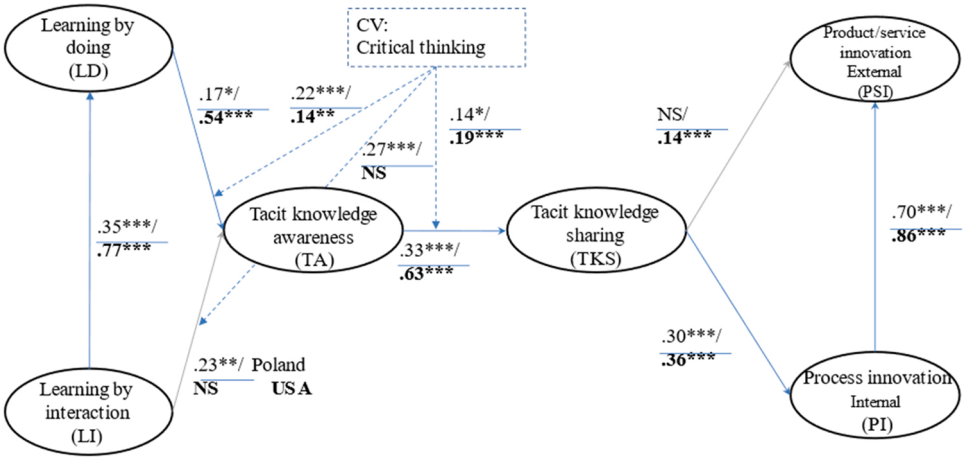

Fig. 2. Empirical Models Results Visualization—Focal Models. Poland results versus US results Note: Poland n = 350 / US = 379 * **p < .001, * *p < .01, *p < .05.

innovation or critical thinking and "learning by doing" and "learning by interaction" were correlated. Consequently, these scales were also validated by applying the procedure of verifying whether the entire measurement tool was nationally invariant. As indicated in Table 2, the agreement of the scales with the constructs was assessed through multigroup CFA (Byrne, 2016). Both sample sizes are above 300, so the more liberal model global fit indices (CFI, RMSEA) were applied (Chen, 2007). The measured change in model fit is around.01 or less for CFI and.015 or less for RMSEA, confirming national invariance (Byrne, 2016; Chen, 2007; Raudenska, 2020). Table 2 also reports alternative models fit indicators, all of which show a similar pattern. Therefore, the correlations noted in the US sample are diagnosed as sample-related rather than caused by faults in the questionnaire or scales.

In addition, the overall project included similar surveys (also n = 350 for each sample segment) of both countries but in the health care and construction industries. As in these results, the outcomes were largely similar across both country and industry, supporting the invariance conclusions.

Referring to Table 1, the KMO test for sample adequacy was .838 for Poland and .908 for the US, confirming the good quality of the samples (Hair, Anderson, Babin, & Black, 2010; Kaiser, 1974). The Harman single factor tests were 23% (Poland) and 33% (US), indicating no single factor was predominant (Podsakoff & Organ, 1986). All samples achieved an acceptable level of common method bias, namely 24% for Poland and 48% for the US, confirming good sample quality and enabling further analysis.

4.4. Measurement models

After positive verification of the samples and questionnaire quality, empirical models were created. This procedure began from the focal models analyzed for Poland and US with and without control variables (CV) imputation. Alternative models were then created.

For the focal models, measured constructs reached indicator loadings (standardized) above the reference level of > .6 (Fornell & Larcker, 1981; Hair et al., 2010). Internal consistency of the constructs was assessed using Cronbach's alpha and a critical level of > .7 (Francis, 2001); AVE was assessed with a test statistic > .5 and composite reliability > .7 (Byrne, 2016; Hair et al., 2010), all establishing scale validity.

Discriminant validity was assessed by comparing the AVE square root against correlations with other constructs (DeVellis, 2017; Fornell & Larcker, 1981; Hu & Bentler, 1999). Results from IBM SPSS AMOS software are presented in Table 3. All AVE square roots were appropriately larger than correlations between constructs with the key exception of the process innovation and product/service innovation constructs. For Poland, the AVE square root is larger than correlation between these constructs but only barely, suggesting the possibility of collinearity. For the US, the AVE square root is larger than one correlation (barely) but not the other. Again, collinearity is suggested. However, this is actually an interesting result itself, particularly because it differs in magnitude across the two samples. The result will be explored in more detail in the discussion of the mediation results.

5. Results

This study aimed to quantitatively explore the key antecedents that are essential for individuals reaching tacit knowledge consciousness and enabling this knowledge to be transformed into innovative solutions. To perform the analysis, two models were proposed: focal and alternative. The main difference between them is that the focal models expose the core of the acquisition and transformation process (with and without CV imputation) and expose the structure of the focal relationships. The alternative models expose the indirect (mediated) relationships revealed through examination of the additional hypotheses (H7a, H7b, H7c and H8a, H8b, H8c) that expand the focal structure. Table 4 clearly presents that the alternative models fit the data better. Logically, the main focus of further analysis and discussion should be better fitting alternative models (Hair et al., 2010). However, for a deeper understanding of the lessons drawn from exploring these phenomena, both models (focal and alternative) are equally useful. Therefore, the results from both (focal and alternative) models are elaborated and discussed.

5.1. Focal B-models results

5.1.1. Hypotheses verification

The results confirm the basic framework of the model, including the key elements of learning, tacit knowledge awareness, tacit knowledge sharing, and innovation. The hypotheses verification results are presented in Table 4. The models are presented both without (Models A) and with (Models B) control variables (Aguinis & Vandenberg, 2014; Carlson & Wu, 2012). Based on these results, all the models are a good fit with the data, but models with the CV better fit the data for both the Polish and US samples, justifying the CV imputation. Therefore, the focal results are presented and discussed based on Models B.

Specifically, the US sample suggests that "learning by doing" has a considerable effect on tacit knowledge awareness (H1b,.54, p < .001) but showed no significant relationship between "learning by interaction" and tacit knowledge awareness (H1a). Further, the influence of "learning by interaction" on "learning by doing" is very strong for the US sample (H2,.77, p < .001). The relationship is also strong between tacit knowledge awareness and tacit knowledge sharing (H3,.63, p < .001);

Table 5
Mediation Analysis of Focal Models.

Mediation	Country	Effects			Mediation type observed
		Total	Direct	Indirect	
TKS→PI→PSI	Poland	.29 (***)	.08 (NS)	.21 (***)	full
	US	.45 (***)	.14(**)	.31 (***)	complementary
LI→LD→TKA	Poland	.29 (***)	.23 (***)	.07(*)	complementary
	US	.50 (***)	NS	.43 (***)	full

between tacit sharing and product/service innovation (H4,.14, $p < .001$), between tacit sharing and process innovation (H5,.36, $p < .001$); and between process innovation and product/service innovation (H6,.86, $p < .001$).

The same full model for the Polish sample (Focal Model B) shows a different pattern. Namely, both "learning by doing" (H1b,.18, $p < .05$) and "learning by interaction" (H1a,.22, $p < .01$) have a significant relationship with tacit knowledge awareness. As with the US sample, a clear connection exists between tacit knowledge awareness and tacit knowledge sharing (H3,.33, $p < .001$); tacit knowledge sharing and process innovation (H5,.30, $p < .001$); and process innovation and product/service innovation (H6,.70, $p < .001$). Interestingly, the relationship between tacit knowledge sharing and product/service innovation (H4) is not significant.

Fig. 2 visualizes all the focal results elaborated above.

5.1.2. Mediation effects

The mediated focal effects (Table 5) reveal that "learning by doing" fully mediates the relationship between "learning by interaction" and tacit knowledge awareness for the US. For Poland, this mediation has a complementary character. In contrast, process innovation is a full mediator between tacit knowledge sharing and external innovation for Poland, whereas for the US, this mediation is partial (complementary). Table 5 below provides details.

5.1.3. Control variable effects

Critical thinking was imputed as a control variable for both samples, with general significance results reported in Table 4 and visualized in Fig. 2 for both countries. For the Polish sample, critical thinking has a relationship with tacit knowledge sharing (Hcv1a,.22, $p < .001$), more so than what is seen in the US (Hcv1a,.14, $p < .05$), but both are significant. This is reversed for the relationship between critical thinking and tacit knowledge awareness (Hcv2,.14, $p < .01$ for Poland;.19, $p < .001$ for the US). These general findings are analyzed in greater depth by applying OLS regression SPSS PROCESS (Hayes, 2018). Fig. 2 presents the general effects visualization while Figs. 3, 4, and 5 present the visualization of detailed interactions. These details demonstrate that critical thinking moderates the effect of "learning by doing" on tacit knowledge awareness for both countries (Fig. 3a–b). Critical thinking moderates the effect of "learning by interaction" on tacit knowledge awareness, but only for Poland (Hcv1b,.27, $p < .001$, Fig. 4), with the US results being insignificant. Finally, critical thinking moderates the effect of tacit knowledge awareness on tacit knowledge sharing for both countries (Fig. 5a–b).

In this and following figures, moderations are visualized applying OLS regression by SPSS PROCESS (Hayes, 2018). Level of confidence for all confidence intervals in output: 95. Number of bootstrap samples for percentile bootstrap confidence intervals: 5000. Nonstandardized effects are presented.

Fig. 3a shows that for Poland, "learning by doing" increases tacit knowledge awareness only for employees with a lower level of critical thinking (CT). This means that in Poland, the "best" critical thinkers do not learn by doing, but in the US they do. Generally, for the US, the higher the intensity level of "learning by doing", the higher the value of tacit knowledge awareness observed for all levels of critical thinking. In addition, Table 3 reveals a higher mean value of critical thinking in the Polish sample than in the US sample (6.50 vs. 5.94) as well as less variation among the sample (standard deviation of.71 vs. 1.30). As a result, only two levels of critical thinking, very high and exceedingly high are visualized for Poland. However, all three levels (high, very high and exceedingly high) of the CT variable were found for the US.

Fig. 4 reveals that the higher the level of "learning by interaction", the higher the tacit knowledge awareness observed for both levels of critical thinkers in Poland.

Fig. 5a reveals that the higher the result for tacit knowledge awareness, the higher the knowledge sharing for both levels of critical thinking identified in Poland. The same result was found for the US (Fig. 5b). However, this relationship was strongest for the higher-level critical thinkers in Poland.

All the results presented above expose critical thinking as a vital factor mitigating tacit knowledge acquisition.

5.2. Alternative models results

5.2.1. Hypotheses verification

The results of the alternative models also confirm the basic framework of the focal model. The main difference is seen in the H4 and H5 verifications. Specifically, the hypothesis about the influence of tacit knowledge sharing on product/service innovation (H4) in the US Focal Model B was supported, but it was not in the alternative model. Similarly, the hypothesis about the influence of tacit knowledge sharing on process innovation (H5) for Poland was supported in Focal Model B, but it was not in the alternative model.

Further, the alternative models include additional hypotheses beyond Focal Models B1 and B2 (H7a, H7b, H7c and H8a, H8b, H8c) directly linking "learning by doing" and "learning by interaction" with process innovation, product/service innovation and tacit knowledge sharing. These hypotheses assumed a positive, direct influence on (i.e., fostering) innovativeness and sharing because of tacit knowledge acquisition. For Poland, all these hypotheses were confirmed except H8b concerning the direct influence of "learning by interaction" on external innovation. Similarly, in the US alternative model, H8b was not supported, along with H8c and H7a, H7b. Thus, it was found that in the US, "learning by doing" and "learning by interaction" do not directly foster either internal or external innovation.

Table 4 reports and Fig. 6 visualizes all the alternative models' results elaborated above.

5.2.2. Mediation effects

The failure to support most of the alternative hypotheses in the US model reveals a tremendous influence of direct acquisition mechanisms on innovativeness (focal models). Thus, since most direct relations added to the alternative models failed, the attention should be turned to expected indirect (mediated) effects.

In the US alternative model, the expected mediation of process innovation (internal) for tacit knowledge sharing and external innovation is confirmed, and the mediation is found to be full. In the US Focal Model B, this mediation was found to be complementary. In contrast, for Poland, there was no mediation found in the alternative model and full mediation found in the focal model.

"Learning by doing" as a mediator between "learning by interaction" and tacit knowledge awareness was confirmed, with the effect being complementary for Poland and full for the US. Both findings are similar to those obtained for the focal models.

The expected mediating effect of tacit knowledge sharing on "learning by interaction" and internal innovativeness in the alternative models was observed as partial for Poland and was not confirmed for the US. In contrast, for the effect of "learning by interaction" on external innovativeness, tacit knowledge sharing was found to be a full mediator

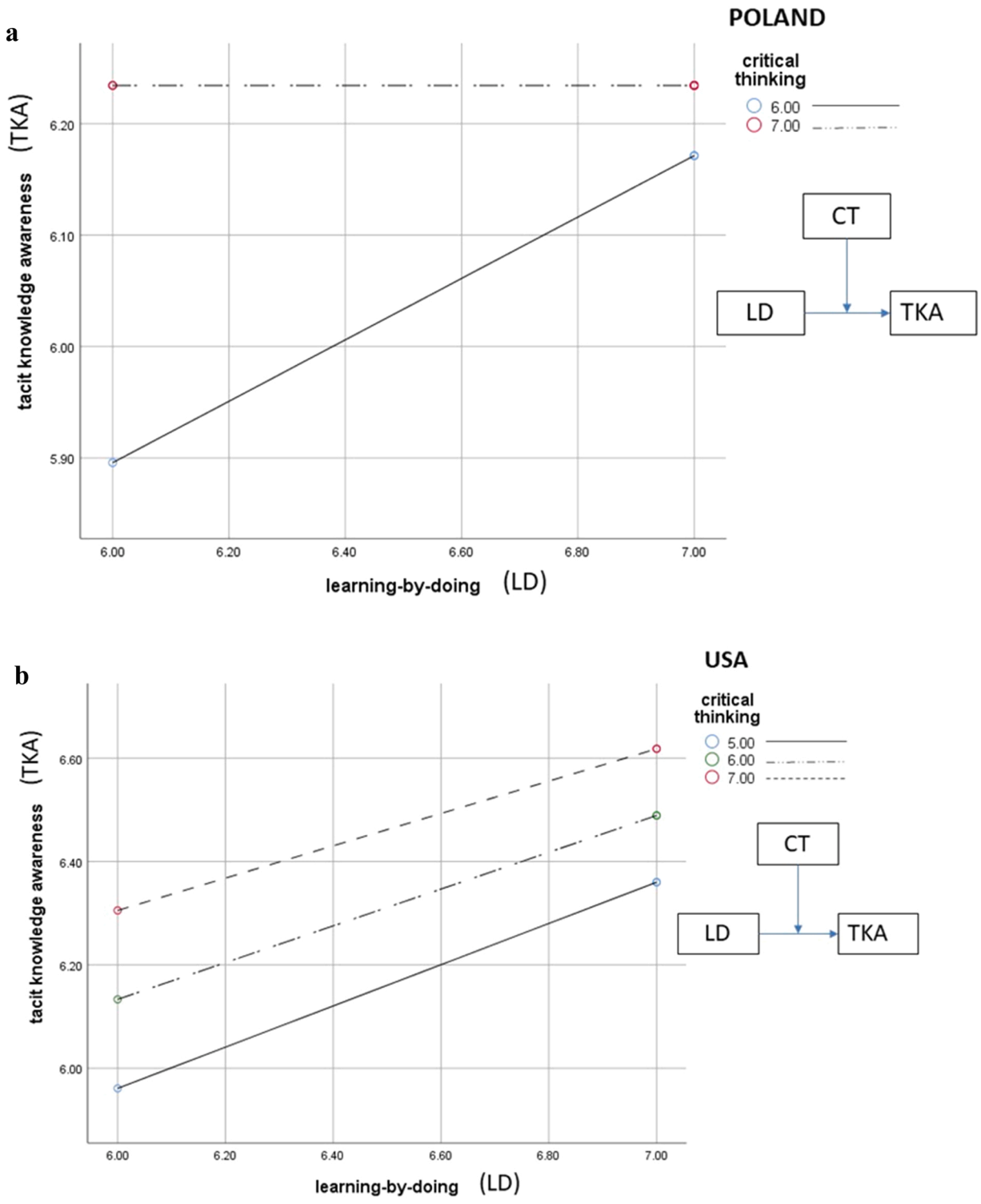

Fig. 3. (a) Interaction Effect of Critical Thinking on the Effect of "learning by doing" on Tacit Knowledge Awareness (Poland). Note: 6-very high and 7-exceedingly high. (b) Interaction Effect of Critical Thinking on the Effect of "learning by doing" on Tacit Knowledge Awareness (USA).

for both countries. However, the alternative expected mediating effect of tacit knowledge sharing on the relationship between "learning by doing" and internal innovativeness was not confirmed for either the US or Poland. In addition, the mediating effect of tacit knowledge sharing on the relationship between "learning by doing" and external innovativeness was not confirmed for the US but was observed as partial for Poland.

The very interesting effects observed for tacit knowledge awareness as an expected mediator between "learning by doing" and "learning by interaction" relate to tacit knowledge sharing. Specifically, tacit knowledge awareness was found to be a complementary mediator in the relationship between "learning by doing" and tacit knowledge sharing for Poland and for the US, and it was also a complementary mediator in the relationship between "learning by interaction" and tacit knowledge sharing for Poland, but it was a full mediator of this relationship for the US.

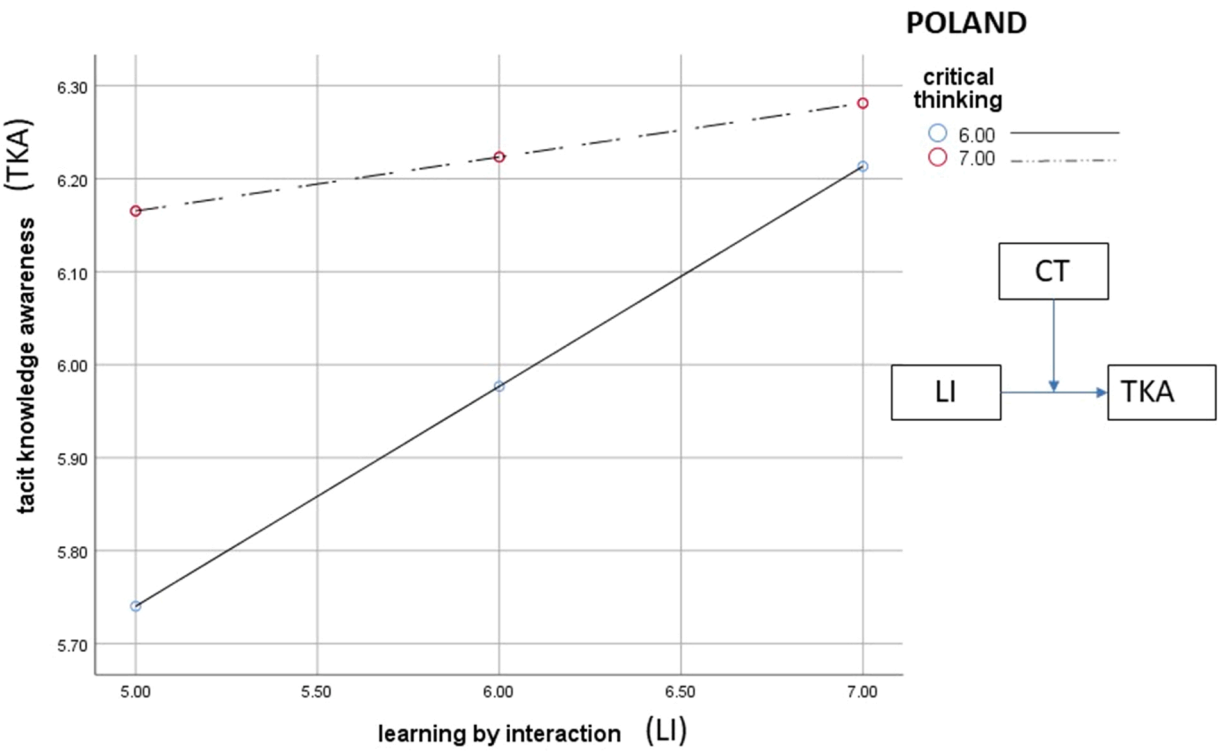

Fig. 4. Interaction Effect of Critical Thinking on the Effect of "learning by interaction" on Tacit Knowledge Awareness (Poland).

Table 6 presents details of all the mediation results elaborated above.

5.2.3. Control variable effects

Critical thinking was imputed similarly in the focal models and the alternative models as a control variable, and its influence on tacit knowledge awareness was also confirmed as significant in the alternative models: Hcv1a,.20, $p < .001$/ Hcv1b,.23, $p < .001$ for Poland and Hcv1a,.16, $p < .01$/Hcv1b, ns for the US. However, the influence of critical thinking on tacit knowledge sharing was confirmed in the focal models but not in the alternative models. These results are reported in Table 4 and illustrated in Fig. 4.

6. Discussion

The literature review noted how the study of tacit knowledge is often based on qualitative case studies or small samples. Important empirical, quantitative studies have been conducted, and this research certainly benefitted from tools and concepts established in those studies, but those have been limited. This paper uniquely contributes comprehensive research bringing together in one model tacit knowledge sources, the relationship of tacit knowledge with innovation, and the details of the path between tacit learning and the innovation outcomes. Importantly, the type and impact of knowledge source (learning by doing/learning by interaction), the application of the tacit knowledge (awareness/sharing), and the nature of the innovation (product/service, process) are all measured in this comprehensive (focal) model, as is the impact of critical thinking. The full range of complex relationships and interactions are uncovered and reported in both the focal and in alternative models. Moreover, the study sheds specific light on the IT industry as well as on how the model might differ between countries.

Consequently, the study helps to fill that large gap in the literature with an empirical, quantitative, comprehensive model concerning how tacit knowledge works in organizations and contributes to competitive advantage. That model includes unique details on the inter-workings of sourcing, sharing and applying tacit knowledge for innovation as well as how the findings change in Poland vs. the US.

6.1. Lessons learned from study results

This study is complex, so the discussion section starts with the "lessons learned" that can then be discussed through the prism of theoretical and practical implications, limitations, and further research directions. The study taught some exciting new lessons thanks to two empirical models: the focal (focal structure exposing direct effects) and the alternative (expanded structure revealing indirect effects). The alternative models were a better fit with the data, but to fully understand the concepts, both models need analysis. Therefore, the lessons learned from both the focal and alternative models are listed and discussed in detail below.

Before that, recall that the basic structure of the conceptual model is based heavily on existing literature. What is new is the empirical evidence from this specific industry (IT) and two different countries. The focal model broadly supports the main relationships in the theoretical model. Tacit knowledge acquisition has some role in the model though its impact varies somewhat by country. The awareness, then sharing, then innovation (both types) pattern is also evident, and critical thinking plays a role, but the exact relationships and impact again vary by country.

The alternative model, on the other hand, explores the intricacies of the basic structure more precisely. Both sources of tacit knowledge are not necessarily important, varying noticeably by country. The awareness to sharing to innovation sequence (and the internal/external innovation relationship) is not as evident in both countries in all circumstances. In short, the role of tacit knowledge and its relationship to innovation is demonstrated to be complex. From a theoretical viewpoint, the work sheds light on these concepts, their relationships, and how additional variables such as critical thinking, industry, and nationality may impact them. On a practical basis, the study shows the importance of firms evaluating their own circumstances, again including industry and national culture, in pursuing optimal development and exploitation of such resources.

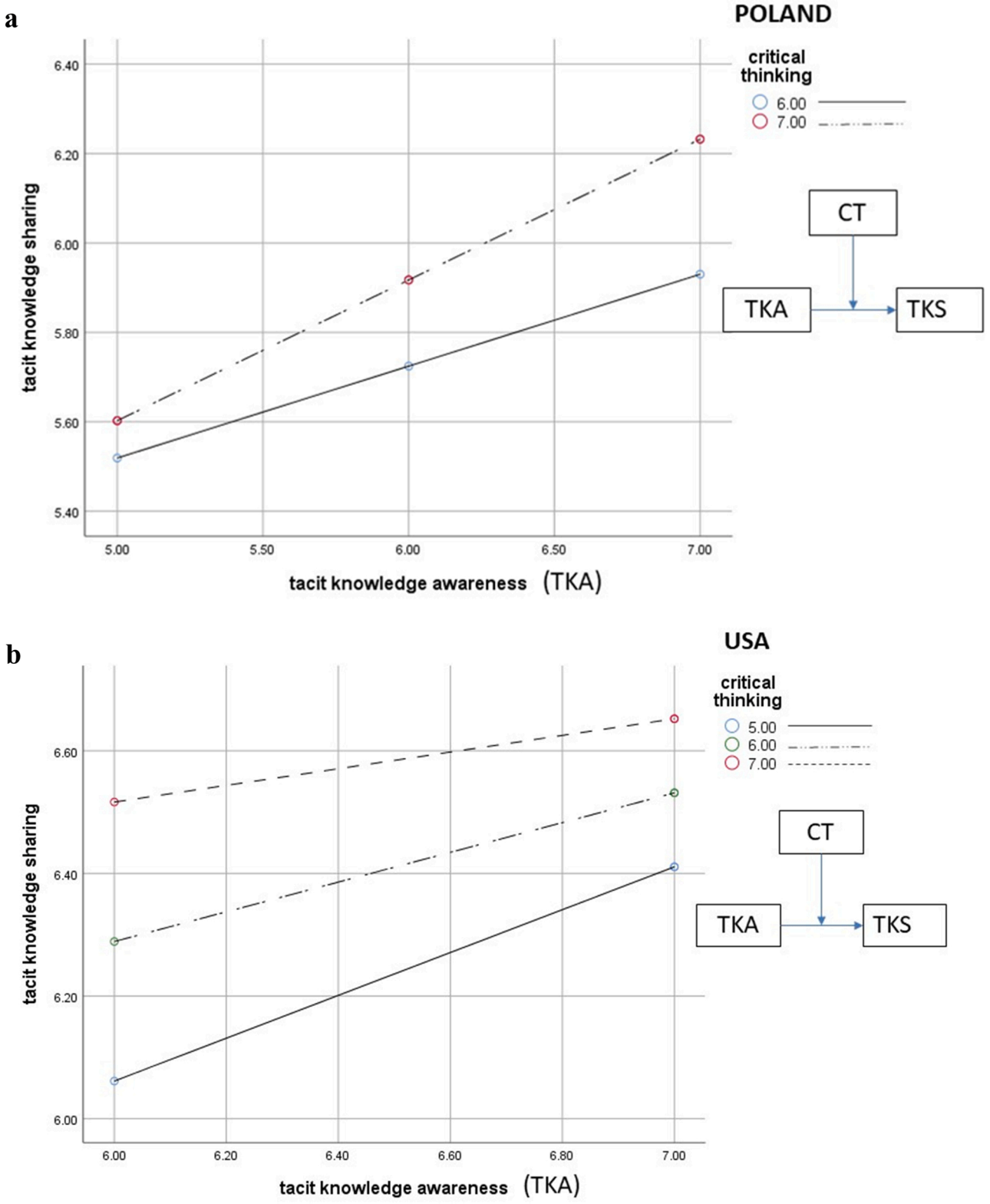

Fig. 5. (a) Interaction Effect of Critical Thinking on the Effect of Tacit Knowledge Awareness on Tacit Knowledge Sharing (Poland). (b) Interaction Effect of Critical Thinking on the Effect of Tacit Knowledge Awareness on Tacit Knowledge Sharing (USA).

6.1.1. Focal models: lessons learned

The focal models provide the empirical evidence captured in the following "lessons learned": A) "Learning by interaction" is a vital predictor of tacit knowledge awareness. It fosters tacit knowledge awareness directly (Poland) and indirectly (Poland partially, US fully). The lesson learned (**LL**): the more interactions at work, the greater likelihood of achieving tacit knowledge awareness. B) "Learning by doing" also influences tacit knowledge awareness, but this influence is stronger in the US. Moreover, this factor is a strong mediator of the relationship between "learning by interaction" and tacit knowledge awareness. **LL**:

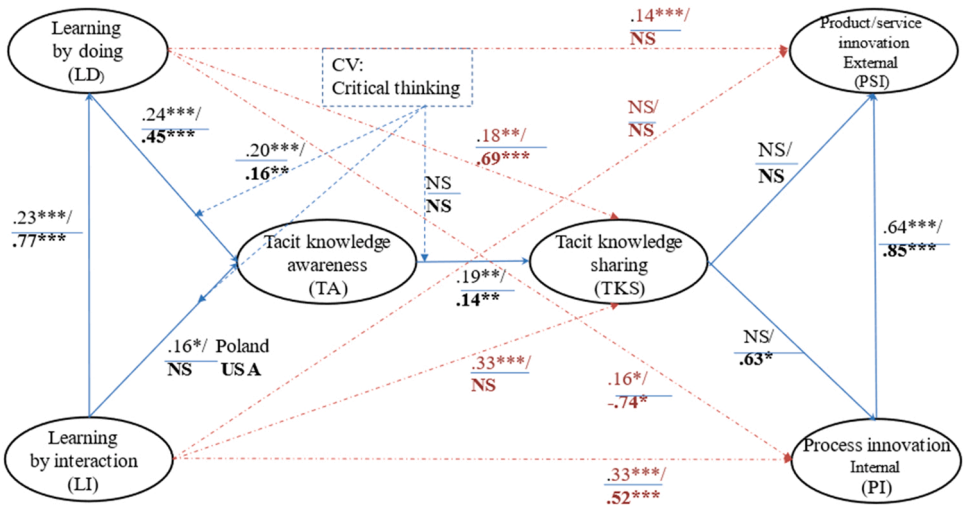

Fig. 6. Empirical Models Results Visualization, Alternative Models. Poland results versus US results Note: Poland n = 350 / US = 379 * **p < .001, * *p < .01, *p < .05.

Table 6
Mediation Analysis of Alternative Models.

Mediation	Country	Effects			Mediation type observed
		Total	Direct	Indirect	
TKS→PI→PSI	Poland	.10 (NS)/	.04 (NS)	.06(NS)	no mediation
	US	.77(*)	.23 (NS)	.54(*)	full mediation
LI→LD→TKA	Poland	.22 (**)	.16(*)	.06(**)	complementary
	US	.43 (***)	.09 (NS)	.34(**)	full
LI→TKS→PI	Poland	.39 (***)	.31 (***)	.08(*)	complementary
	US	.43 (***)	.52 (***)	-.09 (NS)	no mediation
LI→TKS→PSI	Poland	.37 (***)	.07 (NS)	.30 (***)	full
	US	.46 (***)	-.006 (NS)	.47(*)	full
LD→TKS→PI	Poland	.18(*)	.16(*)	.02(NS)	no mediation
	US	-.27 (NS)	-.74(*)	.47(*)	competitive
LD→TKS→PSI	Poland	.27 (***)	.14 (***)	.12(*)	complementary
	US	-.15 (NS)	-.10 (NS)	-.05 (NS)	no mediation
LI →TA→ TKS	Poland	.42 (***)	.33 (***)	.09 (***)	complementary
	US	.76 (***)	.17(ns)	.59 (***)	full
LD →TA →TKS	Poland	.23 (**)	.18(**)	.05(**)	complementary
	US	.76 (***)	.69 (***)	.06(*)	complementary

"learning by doing" should be included in interactions for the best effects. C) Tacit knowledge awareness has a tremendous effect on tacit knowledge sharing. **LL:** organizations should put more effort into organizing working conditions that enable "learning by doing" and help worker interactions go smoothly to foster the tacit knowledge awareness that leads to tacit knowledge sharing. D) Critical thinking moderates the relationship between tacit knowledge awareness and tacit knowledge sharing. The higher the level of critical thinking, the higher the level of tacit knowledge awareness resulting from "learning by doing" in both countries and from "learning by interaction" in Poland. And, again, the awareness then leads to more tacit knowledge sharing. **LL:** workplaces should be organized in a way that promotes critical thinking and reflection. E) The relationship between tacit knowledge sharing and external innovation is fully mediated by internal innovation in the US. **LL:** consequently, organizations should focus on improving their ongoing internal processes and procedures as these can lead to market-based innovations.

Thus, the focal model has provided empirical evidence that "learning by interaction" is a key predictor for tacit knowledge awareness, particularly when supported by critical thinking. Further, achieving tacit knowledge awareness and tacit knowledge sharing supports the internal innovativeness that is also vital for external innovation performance.

6.1.2. Alternative models lessons learned

The alternative models provided empirical evidence that transformed into the following "lessons learned": **A)** "Learning by interaction" is a vital and direct predictor of internal innovation in Poland and in the US. **LL:** this result simplifies the focal models' findings that better social interactions lead to better internal innovativeness in organizations. **B)** "Learning by doing" positively influences tacit knowledge sharing but is negatively linked with internal innovation in the US and is not significant for external innovation. In Poland, all these direct relationships are positive. Therefore, this result simplifies the focal models' findings for the US and illustrates how knowledge conditions can vary between nations. **LL:** tacit knowledge derived from "learning by doing" is positively related to internal innovativeness only if the resulting tacit knowledge is shared. **C)** Tacit knowledge awareness is an important mediator for the relationships between "learning by doing" and "learning by interaction" with tacit knowledge sharing in Poland and in the US. Thus, the alternative models, even when directly linking knowledge acquisition with innovation performance (internal and external), still confirm the findings of the focal models related to the knowledge discovery (tacit knowledge awareness) stage in the process of tacit knowledge acquisition and transformation into innovation. **LL:** tacit knowledge awareness is the key process in the IT organizations interested in innovation creation. **D)** Critical thinking does not moderate the relationship between tacit knowledge awareness and tacit knowledge sharing in the alternative models but remains important for the acquisition mechanisms ("learning by interaction" and "learning by doing") for both countries. This again suggests that the "ba" moment of tacit knowledge consciousness requires specific working conditions where employees collaborate smoothly and freely share opinions (El-Den & Sriratanaviriyakul, 2019; Tyagi et al., 2015). **LL:** tacit knowledge awareness requires good social relations at work and is vital

Table A1
Constructs and Statements.

Construct	Meaning	Statements (created by author)	LoadingsPoland/US
Learning by doing (i.e., learning from own work experience)	"Expert knowledge is derived from education and practical experience accumulated through one's profession … Expert and holistic knowledge mainly reflect tacit forms of knowledge" (Olaisen & Revang, 2018, pp. 1–2) The acquisition of tacit knowledge may occur through "learning by doing" (McLeod et al., 2006). Tacit knowledge that is based on experience and corporal action can be acquired from practical experience in a relevant context (Lam, 1998).	I learn more effectively when I am actually performing tasks.	**.775/.72**
		Task-related practical experience lets me better understand things.	**.816/.737**
		The more I do, the more ideas I have.	**.565/.662**
		I rely on my own experience for learning.	.465/.602
Learning by interaction (i.e., learning from others' work experiences)	"General social interaction is the employees' ability to interact in social settings that are not specifically job related in which they may learn important skills and information" (Insch et al., 2008, p. 568). "Task-related social interaction is the ability to acquire tacit knowledge" (Insch et al., 2008, p. 568)	I learn faster when I work with others.	**.630/.784**
		Feedback helps me learn.	**.832/.724**
		I can learn when I observe how others do.	**.669/.592**
		Colleagues' anecdotes, stories and examples help me learn.	.469/.511
Critical thinking	"Critical thinking (CT) is constructive thinking about the world of ours that questions and evaluates its operations, history, and management" (Oswald et al., 2019, p. 151)	Making sense of things is important to me.	.71/.69
		I learn from constructive questioning.	.76/.72
		I like to evaluate my work and find out better solutions on my own.	.70/.69
Tacit knowledge awareness	Tacit knowledge is a common outcome from many episodes of nonformal learning. It is often a reactive, situational near-spontaneous, and unplanned process. The learner is usually aware of it, but the articulation of its effects in explicit form is delicate without setting aside time for more refection and thus becoming deliberative (Eraut, 2000).	I can create and explain new ideas or insights.	**.688/.825**
		Sometimes I am absolutely sure about a new idea but find it difficult to express.	**.779/.833**
		As I have accumulated experience, I find it is easier to express.	**.664/.742**
		Even if my idea is hard to explain, I am able to express it or demonstrate it.	.464/.442
Tacit knowledge sharing	Tacit knowledge sharing is a voluntary, social process. Sharing informal knowledge is an informal voluntary act of the knowledge owner (Kucharska & Kowalczyk, 2016). Tacit knowledge is obtained and shared through experience (Göksel & Aydintan, 2017).	I share knowledge learned from my own experience.	**.688/.76**
		I have the opportunity to learn from others' experiences.	**.779/.739**
		Colleagues include me in discussions about best practices.	**.472/.744**
		Colleagues share new ideas with me.	.452/**.709**
Process innovation (perceived)	Process innovation is an ability to constantly improvement methods of working (Jimenez-Jimenez & Sanz-Valle, 2011; Jimenez-Jimenez et al., 2008; Manu, 1992).	We constantly improve the way we work.	**.789/.796**
		We are good at managing changes.	**.791/.767**
		We are highly disposed to introduce new methods and procedures.	**.714/.804**
		We are highly disposed to accept new rules.	**.646/.796**
Product/service innovation (perceived)	Product or service innovation is an ability to introduce a competitive new product or service on the market (Eidizadeh et al., 2017; Jimenez-Jimenez & Sanz-Valle, 2011; Jimenez-Jimenez et al., 2008; Manu, 1992).	We provide competitively superior innovations to our clients.	**.847/.796**
		Our innovations are perceived positively by our clients.	**.814/.75**
		We are better than competitors at introducing innovations.	**.559/.835**
		I am proud of our innovations.	**.66/.776**

Note: Bold loadings were incorporated into the models, some loadings were excluded from the models according to the model fit achievement procedure given by Byrne (2016) or Hair et al. (2010). AVE, CR, and Cronbach alphas presented in Table 3 are presented based on the incorporated loadings. Appendix 1 presents the scales in full to make them available for further usage.

for innovativeness.

Summing up, the alternative models expanded the evidence found through the focal models, revealing that tacit knowledge awareness and sharing (internalization and externalization) mediate the acquisition (socialization and experimentation) and application (combination) of tacit knowledge. Such theoretical assumptions have been formulated in previous research (Asher & Popper, 2019, 2021), but have not previously been empirically tested in a single structural model. Further, the alternative models better fit the data and more clearly revealed the relationships. Specifically, the alternative models revealed that most tacit knowledge acquisition obtained through "learning by doing" and some through "learning by interaction" (e.g., observation) occurs unconsciously and is shared and applied directly to the action without clearly reaching the "ba" awareness moment. This outcome is more visible in the US where tacit knowledge awareness and tacit knowledge sharing were not found to be significant mediators for the relationship between "learning by doing" and innovation. However, there is an exception for the relationship between "learning by interaction" and external innovativeness, for which tacit knowledge awareness and tacit knowledge

Table B1
Implied Correlations, Poland and USA.

Construct	LI	LD	TKA	PI	PSI	TKS	CT
LI	1						
LD	.33/ .736	1					
TKA	.306/ .455	.311/ .589	1				
PI	.397/ .438	.277/ .235	.217/ .246	1			
PSI	.393/ .470	.342/ .306	.222/ .330	.724/ .921	1		
TKS	.453/ .743	.324/ .904	.332/ .611	.292/ .368	.292/ .441	1	
CT	.398/ .892	.516/ .891	.375/ .632	.406/ .313	.346/ .399	.364/ .829	1

Note: Poland/US n = 350/379; $\chi 2 = 471.05(254)/575.44(254)$; CMIN/df = 1.85/2.26; RMSEA = .049 /.058; CFI = .927/.935; TLI = .914/.923 TKA - tacit knowledge awareness; CT - critical thinking; LI - learning by interaction; LD - learning by doing; TKS - tacit knowledge sharing; PI - process innovation; PSI - product or service innovation

sharing are full mediators. Thus, the alternative models better fit the data and better reflect the real relationships. However, the lesson from both the focal and alternative models is that better external innovation results are obtained if the consciousness moments occur.

6.2. Theoretical implications

The most direct conclusion from these models is that tacit knowledge acquisition by experience (including experimentation) and socialization should be a core process in IT organizations interested in innovation creation. To enable socialization, the process also requires cohesive relations among workmates. That is in line with Amayah (2013); Chen and Hsieh (2015); and Hau, Kim, Lee, and Kim (2013), who explored social capital's influence on employees' tacit and explicit knowledge sharing intentions through the prism of employees' motivations. Moreover, this study contributes to science by delivering empirical evidence that tacit knowledge internalization and externalization (awareness and sharing) significantly mediate between tacit knowledge experimentation "learning by doing" and socialization "learning by interaction" (methods of acquisition) and its final combination (knowledge in action) reflected in internal and external innovativeness. That contribution fills an identified knowledge gap (Bhadauria & Singh, 2022; Edwards, 2022; Thomas & Gupta, 2021; Yang & Li, 2021). While such theoretical connections already existed, they had not yet been empirically tested and revealed in a single structural model. Empirical evidence shedding light on theory and adding validation changes the discussion. This research had demonstrated that tacit knowledge acquisition and, especially, personal and organizational conditions foster tacit knowledge awareness ("ba" moment) and should be a vital area of interest for both science and practice. Furthermore, this study also exposed that internal and external innovativeness depends on a nation's level of development and economic maturity, encouraging deeper studies concerning tacit knowledge acquisition in different countries' economic and cultural realities. Specifically, the results from the two countries are similar in several ways but also show some key differences. US IT professionals tended to learning by doing more than learning by interaction. These professionals were found to develop tacit knowledge by direct experience rather than sharing with others (Basili, Caldiera, & Rombach, 1994). "Learning by doing" has a strong effect on their awareness of possessing valuable tacit knowledge. Awareness then has a strong influence on their tacit knowledge sharing, which probably needs to be communicated through "learning by doing" as opposed to simply telling (learning by interacting); however, the overlap between the two types of learning requires further exploration. Critical thinking contributes to both tacit knowledge awareness and tacit knowledge sharing. The

Table B2a
Implied Cross-Loadings Correlations, Poland.

Poland	CT.3	CT.2	CT	LI.3	LI.2	LI.1	LD.1	LD.2	LD.3	TKA.4	TKA.3	TKA.2	TKA.1	PI4	PI3	PI2	PI1	PSI4	PSI3	PSI2	PSI1	TKS.4	TKS.3	TKS.2	TKS.1
CT.3	1																								
CT.2	.517	1																							
CT.1	.387	.378	1																						
LI.3	.195	.19	.142	1																					
LI.2	.235	.229	.172	.545	1																				
LI.1	.189	.184	.138	.437	.528	1																			
LD.1	.294	.286	.215	.173	.209	.168	1																		
LD.2	.301	.294	.22	.178	.214	.172	.628	1																	
LD.3	.216	.21	.158	.127	.154	.124	.45	.461	1																
TKA.4	.182	.177	.133	.137	.165	.133	.162	.166	.119	1															
TKA.3	.111	.108	.081	.084	.101	.081	.099	.102	.073	.271	1														
TKA.2	.212	.207	.155	.16	.193	.155	.19	.194	.139	.518	.316	1													
TKA.1	.192	.187	.14	.145	.174	.14	.171	.176	.126	.468	.286	.547	1												
PI4	.191	.186	.14	.173	.208	.167	.14	.144	.103	.094	.057	.109	.099	1											
PI3	.211	.206	.154	.19	.23	.185	.155	.158	.114	.103	.063	.121	.109	.462	1										
PI2	.234	.228	.171	.212	.255	.205	.172	.176	.126	.115	.07	.134	.121	.513	.565	1									
PI1	.233	.227	.17	.21	.254	.204	.171	.175	.125	.114	.07	.133	.12	.509	.562	.624	1								
PSI4	.167	.162	.122	.175	.211	.169	.177	.182	.13	.098	.06	.114	.103	.31	.342	.38	.377	1							
PSI3	.139	.136	.102	.146	.176	.141	.148	.152	.109	.082	.05	.095	.086	.259	.285	.317	.315	.365	1						
PSI2	.206	.201	.151	.216	.261	.209	.219	.225	.161	.121	.074	.142	.128	.384	.423	.47	.467	.542	.452	1					
PSI1	.213	.208	.156	.223	.269	.216	.227	.232	.166	.125	.076	.146	.132	.396	.437	.485	.482	.559	.467	.692	1				
TKS.4	.21	.204	.153	.241	.291	.234	.201	.206	.148	.175	.107	.204	.185	.15	.165	.183	.182	.153	.127	.189	.195	1			
TKS.3	.217	.211	.158	.249	.301	.242	.208	.213	.153	.181	.11	.211	.191	.155	.171	.19	.188	.158	.132	.196	.202	.648	1		
TKS.2	.126	.123	.092	.145	.175	.141	.121	.124	.089	.105	.064	.123	.111	.09	.099	.11	.11	.092	.077	.114	.117	.377	.39	1	
TKS.1	.139	.135	.101	.159	.192	.154	.133	.136	.098	.115	.07	.135	.122	.099	.109	.121	.12	.101	.084	.125	.129	.414	.429	.249	1

Table B2b
Implied Cross-Loadings Correlations, USA.

US	CT.3	CT.2	CT.1	LI.3	LI.2	LI.1	LD.1	LD.2	LD.3	TKA.4	TKA.3	TKA.2	TKA.1	PI4	PI3	PI2	PI1	PSI4	PSI3	PSI2	PSI1	TKS.4	TKS.3	TKS.2	TKS.1
CT.3	1																								
CT.2	.436	1																							
CT.1	.472	.483	1																						
LI.3	.269	.274	.297	1																					
LI.2	.432	.441	.478	.339	1																				
LI.1	.462	.472	.511	.362	.582	1																			
LD.1	.431	.44	.477	.25	.402	.43	1																		
LD.2	.418	.427	.463	.243	.39	.418	.532	1																	
LD.3	.364	.372	.403	.212	.34	.364	.464	.45	1																
TKA.4	.312	.319	.345	.158	.254	.271	.329	.32	.279	1															
TKA.3	.23	.235	.254	.116	.187	.2	.242	.235	.205	.42	1														
TKA.2	.343	.35	.379	.173	.279	.298	.362	.351	.306	.626	.461	1													
TKA.1	.358	.366	.396	.181	.291	.312	.378	.367	.32	.655	.482	.719	1												
PI4	.158	.161	.175	.155	.25	.267	.135	.131	.114	.143	.106	.158	.165	1											
PI3	.165	.168	.182	.162	.26	.278	.14	.136	.119	.149	.11	.164	.172	.621	1										
PI2	.158	.161	.174	.155	.249	.266	.134	.13	.114	.143	.105	.157	.164	.594	.619	1									
PI1	.162	.165	.179	.159	.256	.274	.138	.134	.117	.147	.108	.161	.169	.61	.636	.609	1								
PSI4	.202	.206	.224	.168	.269	.288	.176	.171	.149	.194	.142	.213	.222	.552	.575	.55	.565	1							
PSI3	.218	.222	.241	.181	.29	.31	.189	.184	.16	.209	.154	.229	.239	.595	.62	.593	.61	.649	1						
PSI2	.195	.199	.216	.162	.26	.278	.17	.165	.144	.187	.138	.205	.215	.533	.555	.531	.546	.582	.627	1					
PSI1	.207	.211	.229	.172	.276	.295	.18	.175	.152	.198	.146	.218	.228	.565	.589	.564	.579	.617	.665	.596	1				
TKS.4	.38	.388	.421	.239	.384	.411	.469	.455	.397	.323	.238	.355	.371	.199	.207	.199	.204	.24	.258	.232	.246	1			
TKS.3	.418	.427	.463	.263	.423	.452	.516	.501	.437	.356	.262	.391	.408	.219	.228	.219	.225	.264	.285	.255	.27	.54	1		
TKS.2	.39	.399	.432	.246	.395	.422	.482	.468	.408	.332	.245	.365	.381	.205	.213	.204	.21	.246	.266	.238	.252	.504	.555	1	
TKS.1	.415	.424	.46	.261	.42	.449	.512	.498	.433	.353	.26	.388	.405	.218	.227	.217	.223	.262	.282	.253	.268	.536	.59	.551	1

Table B3a
Cross-Loadings Matrix, Poland.

	Loadings						
Item	1	2	3	4	5	6	7
PSI2	**.854**						
PSI1	**.795**						
PSI3	**.570**				-.110		
PSI4	**.557**					.115	
PI1		**.768**	.104		.168		
PI3		**.747**					
PI2		**.732**				.136	
PI4	.140	**.536**			-.207		.176
TKS.3			**.896**		-.120		
TKS.4			**.789**				
TKS.2	.104		**.447**				
TKS.1			**.389**		.193		
TKA.2				**.793**			-.142
TKA.1				**.710**			
TKA.4				**.663**			
TKA.3				**.391**			
LD.2					**.877**		
LD.1					**.752**		
LD.3					**.428**		.161
LI.3						**.841**	
LI.2		.107				**.747**	
LI.1						**.591**	
CT.3							**.838**
CT.2	-.115	.120			.143		**.600**
CT.1	.165		-.138	.136			**.434**

Loadings extraction method - Maximum Reliability.
Rotation method - Promax with Kaiser normalization.

Table B3b
Cross-Loadings Matrix, Poland.

	Loadings						
Item	1	2	3	4	5	6	7
PSI2	**.868**				-.122		.124
PSI1	**.848**						-.109
PSI3	**.773**						
PI1	.760					.166	-.160
PSI4	**.682**	.125					.122
PI3	.626				.233		
TKS.4		**.801**	-.148		.132		.140
TKS.1		**.793**					-.408
TKS.2		**.711**					-.108
TKS.3		**.680**					
LD.2		.664	.190	-.134			
LD.1		.614	.113				-.190
LD.3		.544					
LI.4			**.753**	-.124		-.123	
LI.2			**.742**			.205	
LI.3			**.714**				
CT.3			.567	.173			
CT.2			.515	.162		.126	
CT.4			.344	.144		-.153	
TKA.1				**.864**			
TKA.2		.109		**.743**			
TKA.4		.329		**.366**			.184
PI4	.252					.827	
PI2	.406					.595	

Loadings extraction method - Maximum Reliability.
Rotation method - Promax with Kaiser normalization.

knowledge sharing leads to both process and product/service innovation, and process innovation then has a strong connection to product/service innovation.

Polish IT professionals report both "learning by doing" and "learning by interaction", suggesting more sharing in the knowledge acquisition process and that the source of tacit knowledge can vary by nation. This learning leads to tacit knowledge awareness and then to tacit knowledge sharing; a relationship that is stronger in Poland than in the US sample

because interaction is observed as more significant to gaining the knowledge in Poland. Tacit knowledge sharing leads to process innovation and only then, indirectly, to product innovation. Critical thinking is an influence on both tacit knowledge awareness and tacit knowledge sharing.

In both samples, there is a clear link between some kind of learning and awareness. Particularly strong in the US is "learning by doing" and thereby gaining some awareness of possessing useful tacit knowledge. In line with the literature, this suggests that tacit knowledge is something more hidden or non-representable (Asher & Popper, 2019; Olaisen & Revang, 2018), and that knowledge holders have reflected on their learning, including through critical thinking, and have recognized what they know and the usefulness of their knowledge. This connection is slightly weaker in the Polish study and includes more social "learning by interaction", but the process of reflection and recognition is similar for both countries.

The step from tacit knowledge awareness to tacit knowledge sharing is also apparent in both samples, but it is again stronger in the US. Critical thinking is once more an influence. In previous studies, an individual's reflection on tacit knowledge and its usefulness internalizes the learning (Oswald & Mascarenhas, 2019) and helps to instill confidence and a sense of expert power leading to a willingness to share with others (Wipawayangkool & Teng, 2016a, 2016b). An aspect of personal, individual confidence may be present and is perhaps a reason there is a stronger correlation observed between tacit knowledge awareness and tacit knowledge sharing in the US.

In both samples, process innovation is more strongly connected to tacit knowledge sharing than is product/service innovation; however, the link between process and product/service innovation is significant and substantial. The idea that product/service innovation flows from tacit knowledge sharing, even if indirectly, is confirmed by the mediation results. This seems to make sense, but as noted, the weakness of the discriminant validity, particularly in the US sample, raises some questions of the possibility of construct loadings confounding. Respondents may not see a distinction between the everyday process improvements close at hand and the more dramatic product/service innovations launched by the firm as a whole. It might also be possible that the two types of innovation are so closely related in practice, as somewhat suggested by the results, that they are perceived as one and the same by the respondents. Although tacit knowledge is considered to play an important role in product/service innovation, particularly the "fuzzy front end" (Sakellariou et al., 2017) when knowledge is more unstructured and abstract or creative ideas are generated, solving unexpected and non-standard problems are more often the responsibility of the R&D department and explicit processes. The professionals in these samples are not R&D scientists and engineers but are largely IT middle managers and professionals. IT lends itself to a great deal of problem solving and operational solutions, which means in the IT context, one sees more of the incremental process improvements that occur on a daily basis. While such improvements can and do accumulate to lead to more disruptive product/service innovations, they are not necessarily part of the immediate work of the respondents (from which they learn). Instead, the more disruptive innovations are more often the outcome of their collective knowledge being funneled through R&D's new product development processes.

Moreover, it is worth noting that the Polish sample was more based in small companies and the US sample included some professionals in larger companies (Table 1). So, bearing in mind all the differences between national models, these differences may be due not only to cultural (national) reasons but also to structural reasons such as company size and maturity. The successful introduction of novelty to the market is more complex than having the initial brilliant idea, as is suggested by the simplified model. In reality, production, distribution, promotion, and other developments are all needed to achieve market success. Altogether, one might add a post-hoc hypothesis that company maturity and size may (positively or negatively) moderate the mediating effect of tacit knowledge sharing on product/service innovation through process innovation. It may be that small companies on the one hand are faster and more flexible than large companies, but on the other are also less experienced. If so, the observed difference between Poland and the US should be explored more deeply, including such factors as company size and maturity, hierarchy, market structure, parent/subsidiary relationships, or differences in general economic maturity.

6.3. Managerial implications

As noted, this study has demonstrated that tacit knowledge acquisition among workmates should be one of the key processes in IT organizations interested in innovation creation. Internalization and externalization of tacit knowledge may occur consciously or unconsciously. But it is much better for overall organizational innovativeness if the shared consciousness moment occurs. Therefore, organizational efforts to manage autonomous, informal, and strongly contextual tacit knowledge are worthwhile and capable of creating the capacity for superior competitive advantage. The tacit knowledge awareness stage is the critical part of the tacit knowledge acquisition and transformation into innovation process.

The theoretical process of obtaining, recognizing, sharing, and innovating through tacit knowledge has been validated in this study. However, as noted, the study found important differences between the two samples from Poland and the US, suggesting that the general business context may be important in managing tacit knowledge. The two nations were chosen mostly because of the differences in their economic maturity, with the US being a highly developed economy and Poland being a fast-growing but still developing economy. Although the sample was constructed to ensure similar representation by company position from both countries (i.e., c-suite, top managers, middle managers, professionals), the size of the company for which the professionals worked was not controlled, and it is thus a potential variable affecting applications of tacit knowledge. The Polish sample was mostly from small firms (77%) while the US sample had quite a large percentage from medium (25%) and large (66%) firms. Given that middle managers and professionals may have very different duties in large, medium, and small firms, the size of the firm could have affected the model results. Smaller firms may enable more "learning by interaction", with more professionals working together across functions. In contrast, smaller firms could have less sharing of task-related tacit knowledge if departments are smaller or nonexistent—there may simply be fewer workers at a comparable level with whom to share tacit knowledge. In addition, the question about whether innovation comes from small or large firms, as well as the nature of the innovation (product/service vs. process) could also be an influencing factor that our study did not test. The mediation result finding that process innovation plays a greater role in product/service innovation in Poland as well as the lack of discriminant validity may very well be related to the influence of the size of the company, its innovation strategy (e.g., pioneering, incremental), and its innovation capabilities. These results may also be affected by the IT industry itself and how innovation proceeds in developing hardware, software, or consulting offerings.

However, of probably even greater importance to the differences between the countries' samples would be the cultures of the countries themselves. International business literature is full of country comparisons based on cultural differences. Probably the best known are the Hofstede (1984) indices. The original four indices include power distance, individualism/collectivism, uncertainty avoidance, and masculine/feminine. To these four have been added long-term/short-term orientation and indulgence/restraint.

The Hofstede indices can provide an initial reading on how national cultures differ. Obviously, dependence on a single metric without reference to more regional or local differences can provide misleading results, but as a broad indicator suggesting directions for further research, the indices can be useful. Recent readings on the two countries

in question include (Hofstede Insights, 2020) the following: power distance (Poland 68, US 40); individualism (Poland 60, US 91); masculinity (Poland 64, US 62); uncertainty avoidance (Poland 93, US 46); long-term orientation (Poland 38, US 26); indulgence (Poland 29, US 68).

As seen, considerable differences are apparent between Poland and the US for several of the indicators. In particular, the Polish are much more respectful of hierarchy and authority (power distance); both cultures are individualistic, although the US is more so (individualism); the Polish much prefer settled environments (uncertainty avoidance); and the US is less restrained (indulgence). These aspects might explain some of the differences found in the study and its potential for wider applicability. From reflecting on the knowledge, the holder of the knowledge gains self-assurance in their own expert power and the value of the knowledge they hold, then moving on to share it confidently with others. In doing so, the individual must be willing to act as an individual—even though sharing is group-oriented, the willingness to stand out and advise others shows individual self-confidence. Further, research has indicated that informal networks often develop within organizations based on knowledge sources (unlike formal reporting structures), so effective knowledge sharing also depends to some degree on having less respect for established hierarchies. Implicit in this, as well as in the attitude toward risk-taking innovation (particularly product/service innovation), is comfort with facing uncertainty and risk.

It is always a little risky to make broad conclusions based on the Hofstede (1984) indices, and they have their critics. These indices are very general, can have broad differences within a given nation, and should probably be supported by additional in-depth qualitative data. However, as a first step, they certainly suggest that part of the differences in the results for the two samples in this study may be based on national culture differences as well as some of the other factors discussed above. Consequently, applying the results in a specific national environment should be done with care. The evidence in this study suggests that obtained national results can be different, e.g., national, maturity, and structural circumstances, and so national differences in tacit knowledge acquisition, awareness, sharing, and impact may also be an interesting direction for future research.

6.4. Limitations and future research directions

This study has some limitations that must be acknowledged. First, it was conducted in the context of only one industry (IT). Second, the sample profile has recognizable patterns in relation to the size distribution of firms. Third, the study was conducted in only two different types of nations.

In particular, the study finds key differences between the two samples from Poland and the US. There are readily apparent differences between the countries, from economic maturity to national culture. Additionally, the samples have differences in the distribution of companies by size and, by implication, the level of responsibility of respondents even if, nominally, they hold similar positions. Any or all of these factors could have influenced the findings of the prominent differences in results for the two countries such as the primary sources of tacit knowledge ("learning by doing" vs. "learning by interaction") as well as the path to product/service innovation. Magnitudes and correlations also differ somewhat, even if the results are emphatically significant in both samples.

These results suggest that something in the environment of the two countries might affect the development, sharing, and influence on innovation of tacit knowledge. Literature has often focused on variables that might leverage the effect of knowledge or that might make knowledge management systems more or less successful (e.g., organizational culture). Given what we know about this study, the differences in national economic maturity; national culture; firm characteristics (including size); particular aspects of the IT industry; and other variables may be responsible for the disparate outcomes.

Consequently, considerable opportunities exist for further research. The study produced key findings in relation to sources of tacit knowledge, their contribution to the development of tacit knowledge and willingness to share, and then the effect on innovation. The results indicate that any and all of these relationships may vary by context (e.g., culture, industry). Additional research can explore the importance of the industry characteristics. IT has very clear types of knowledge used in creating and improving software, hardware, and integrative offerings, which may be more or less tacit than what is found in other industries. IT also has distinct innovation outputs, much of these incremental or related to problem solving (i.e., more process-oriented) despite also including product/service introductions. Other industries may not show the same patterns and examining different industries would clarify the quantitative model for tacit knowledge presented here.

Similarly, samples with a different representation of company sizes would also provide more evidence about what is causing the results presented in this study. In smaller firms, employees often have a wider range of duties while those in larger firms can specialize. Further, foreign subsidiaries (which are present to some degree in the Polish sample) could also affect the generation and use of local tacit knowledge. Studying these aspects of organizational environments could also provide a deeper understanding of the workings of tacit knowledge and innovation.

Each of these areas for additional research can and should include the perceived distinction between process and product/service innovation. As indicated, innovation is a key and significant output of the model, and the results also suggest some lack of clarity about the difference between the two types of innovation. This could be due to a flaw in the instrument despite some of the items having been validated in previous studies. This could also be due to differences in how innovation is pursued in the IT industry and/or in companies of different sizes. This lack of clarity on what is affecting the outcomes means that additional research into the findings is warranted.

Furthermore, the details regarding reliabilities of the scales used here are presented in Appendix 2, confirming their application in the Polish sample. But the appendix also provides results concerning the US's overlapping scales. For the US, the tacit knowledge sharing and "learning by doing" scales loadings are a little bit too close, similarly, to "learning by interaction" and critical thinking and internal and external innovation loadings. Since the invariance analysis exposed that the measurement tool is nationally invariant based on other industries studied, the likeliest explanation would be: a) "learning by doing" is an important way for people in the US to share tacit knowledge, e.g., by demonstration; b) critical thinking happens collectively, e.g. people discuss the best solutions, so they interact; c) as elaborated earlier, the US's IT industry is innovation-oriented, so firms improve themselves inside to perform better outside.

That seems a plausible explanation of the findings, but further studies are needed to verify it.

The importance of understanding the organizational learning context is further magnified by the COVID-19 pandemic. Specifically, the recent remote working trend provokes questions about technology-supported tacit knowledge acquisition and organizational learning. Therefore, in the context of the prior studies of Adamovic (2022); Chamakiotis, Boukis, Panteli and Papadopoulos (2020); Chamakiotis, Panteli and Davison (2021); Dwivedi et al. (2020); Papagiannidis, Harris, and Morton (2020); and Papagiannidis and Marikyan (2022), technology-mediated tacit knowledge acquisition seems to be an auspicious direction of further studies.

Finally, this study examines only Poland and the US as the country contexts. Results from other countries, including those in the EU or in other developed and developing economies could also help to clarify the results and provide guidance on the nature of tacit knowledge and its management in different national contexts. Further, just as qualitative research can be a guide to subsequent quantitative studies, follow-on qualitative work could be useful in uncovering some of the reasons

behind what was found in this study. In particular, conclusions suggested by blunt tools such as the Hofstede (1984) indices could be explored in more detail by probing workers from different countries about the hows and whys of the quantitative results.

7. Conclusion

Tacit knowledge acquisition and sharing among workers should be a priority for IT organizations interested in innovation. Tacit knowledge creation can be directly linked to innovation outcomes, whether the source of knowledge is hands-on learning (learning by doing) or sharing by others (learning by interaction). The application of acquired tacit knowledge can be influenced by workers' awareness of possessing it as well as by their willingness to share it with others. Awareness and sharing are important to the effective application of knowledge for innovation, and these can be effective tools for making organizations more innovative. Further, critical thinking, which can stimulate awareness as well as willingness and intention to share is also an important component of effective tacit knowledge application. Again, workplaces can enhance innovation by encouraging reflection and critical thinking. Shared tacit knowledge can be an important precursor to both internal process innovation and external product/service innovation.

Many of these relationships have been theorized and tested in previous research. This study uniquely provides direct empirical evidence of the full process and all of the interrelationships between these variables, from tacit knowledge acquisition to its recognition (or not) and sharing and on to internal and external innovation. The study also includes two countries at different stages of economic development. The national differences show how these variables can diverge, how countries can utilize different sources of tacit knowledge, process it in different ways, and employ it for different types of innovation. The study effectively brings together multiple concepts from the tacit knowledge literature, combines them in a single quantitative, empirical model, and provides evidence of national differences in how the model works.

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Declarations of interest

None.

Appendix A

See Appendix Table A1 here.

Appendix B. : CFA Models

See Appendix Table B1, Table B2a, Table B2b, Table B3a, Table B3b here.

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