

Competence development as a driver of innovative and sustainable public procurement

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Abstract

Purpose – This study aims to examine how individual competence categories (enabling, procedural and relational) and their direct and indirect development are related to innovation, sustainability and operational performance in public procurement.

Design/methodology/approach – Survey data were collected from 173 public procurement professionals in Finland and the Netherlands. Using Consistent Partial Least Squares Structural Equation Modeling (PLS-SEM), complemented by Necessary Condition Analysis (NCA), the study analyzes how competence development mechanisms are associated with individual competence levels and how these competences relate to performance outcomes.

Findings – Results show that relational competences have the strongest positive associations with innovation and operational performance, while procedural competences are positively related to operational and sustainability outcomes but show a non-significant, slightly negative association with innovation. Enabling competences are strongly related to procedural and relational competence levels. Both direct and indirect competence development mechanisms are positively related to competence levels, although the observed effects are moderate.

Research limitations/implications – While based on cross-sectional evidence, these results point to avenues for advancing understanding of how competence development relates to innovative and sustainable public procurement across institutional contexts.

Social implications – The findings highlight the importance of supporting complementary competence development through internal learning structures, while using external collaboration selectively as part of longer-term competence development efforts.

Originality/value – This study offers an empirical analysis of a holistic model linking competence development mechanisms to individual competence levels and performance outcomes in public procurement.

Keywords Competence, Competence development, Public procurement, Innovation, Sustainability, Survey

Paper type Research paper

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1. Introduction

Public procurement professionals operate in a demanding environment, where they are expected to ensure compliance, efficiency and accountability while also contributing to broader policy goals such as innovation and sustainability (Karttunen *et al.*, 2025; Taheriruh *et al.*, 2025). Through strategic procurement, public organizations can not only deliver essential goods and services efficiently but also foster markets for sustainable solutions and innovative technologies (Grimbert *et al.*, 2024; Malacina *et al.*, 2022). However, achieving all these outcomes in practice is not straightforward. Previous research across different public procurement settings shows that public organizations often struggle to move beyond operational, cost-focused and compliance-oriented approaches and to pursue wider policy objectives more actively (Malacina *et al.*, 2025; Taheriruh and Moshtari, 2024). Prior research emphasizes competence-related limitations, highlighting that public procurement professionals are not always sufficiently equipped to address innovation- and sustainability-related demands in their daily work (Grimbert *et al.*, 2024; Santos and Cabral, 2022; Taheriruh *et al.*, 2025). Recent evidence from European countries further indicates that, despite the increasing availability of procedures and policy instruments, competence gaps remain prevalent, pointing to a continued need for systematic competence development (European Commission, 2020a, 2020b; Oksanen and Merisalo, 2023). Therefore, realizing this dual role, achieving both operational and strategic performance, requires advanced individual and organizational competences (Holma *et al.*, 2022; Karttunen *et al.*, 2024; Loijas *et al.*, 2024). Accordingly, developing competence is an important issue for both research and practice in public procurement (Taheriruh *et al.*, 2025).

Competences are defined as “knowledge, skills and abilities that are key to developing and realizing organizational goals” (Barnes and Liao, 2012). Competence extends beyond the ability to perform technical and procedural tasks, to include the ability to communicate and collaborate with others, as well as higher-order competences such as critical thinking, learning and leadership that enable the use and development of other competences (Stek and Schiele, 2021; Taheriruh *et al.*, 2025). In procurement research, growing attention has been paid to the competences and related capabilities needed as procurement has moved from a mainly operational function toward a more strategic one (Bals *et al.*, 2019; Stek *et al.*, 2025). This has included increasing attention to abilities such as collaboration, systems thinking and adaptive problem-solving, in addition to more technical and procedural forms of expertise (Stek and Schiele, 2021). Beyond technical expertise, this includes collaborative, problem-solving and learning-oriented abilities that enable procurement professionals to respond to evolving demands (Stek and Schiele, 2021; Kelly *et al.*, 2025). While procurement operates in different institutional contexts, it also shares common functional foundations across public and private sectors and prior research suggests that many core competence requirements, such as collaboration, systems thinking and adaptive problem-solving, are comparable across private and public procurement settings (Stek and Schiele, 2021; Beske-Janssen *et al.*, 2023; Taheriruh *et al.*, 2025).

In particular, public procurement literature has increasingly paid attention to both individual competences and organizational capabilities, highlighting their role in enabling organizations to manage procurement activities and achieve broader policy objectives (Holma *et al.*, 2022; Loijas *et al.*, 2024; Loosemore *et al.*, 2022). In the public sector, procurement professionals operate under formalized procedures and political accountability while being expected to stimulate innovation and sustainability (Cabral, 2017; Malacina *et al.*, 2022). In this context, competences in public procurement are not only related to operational goals but also to enabling organizations to adapt, collaborate and pursue broader policy goals such as innovation (Grimbert *et al.*, 2024) and sustainability (Berg *et al.*, 2022).

At the same time, limitations in administrative and organizational capabilities have been identified as a barrier to effectively implementing innovation-oriented procurement policies, highlighting the importance of understanding how such competences are developed and applied in practice ([Grimbert et al., 2024](#); [Holma et al., 2022](#); [Taheriruh et al., 2025](#)).

While prior studies have offered valuable insights into procurement competences, much of this research has focused on private-sector purchasing and supply management contexts ([Bals et al., 2019](#); [Beske-Janssen et al., 2023](#); [Kelly et al., 2025](#); [Schulze et al., 2019](#)), which may also inform the understanding of procurement competences in other contexts. In contrast, public procurement has received comparatively less attention, despite the fact that competence-related issues take different forms due to formalized procedures, political accountability and policy-driven objectives ([Santos and Cabral, 2022](#); [Taheriruh et al., 2025](#)). However, much of this work remains exploratory and there is still limited empirical testing on how different competence categories influence procurement outcomes and how competence development activities shape competence levels in public procurement ([Taheriruh et al., 2025](#)).

To address these gaps, a more integrative perspective is needed that captures competence categories, their development mechanisms and their links to procurement outcomes. This study responds to that need by building on the competence framework of [Taheriruh et al. \(2025\)](#), which conceptualizes competences in public procurement as both used and developed through interaction. This framework is particularly suitable as it is developed in the context of public procurement and focuses on individual competences, unlike prior research that has either examined competence categories in private-sector contexts (e.g. [Bals et al., 2019](#)) or emphasized organizational-level capabilities (e.g. [Holma et al., 2022](#); [Santos and Cabral, 2022](#)). It also provides a more holistic perspective by linking competences, their development and their effects on performance.

The framework distinguishes three competence categories: procedural competences relate to procurement processes and execution, relational competences to collaboration with stakeholders and enabling competences to higher-order abilities such as learning and leadership that support the other two categories ([Taheriruh et al., 2025](#)). It also differentiates between two development mechanisms: direct development through intentional internal learning activities such as training and mentoring and indirect development through interaction with external actors ([Taheriruh et al., 2025](#)).

Accordingly, this study examines how these competence categories and development mechanisms relate to procurement performance in public organizations. Specifically, it addresses the following research questions:

- RQ1. How do individual competence levels (procedural, relational and enabling) contribute to innovation, sustainability and operational performance in public procurement?
- RQ2. How do competence development mechanisms (direct and indirect) affect the competence levels of procurement professionals?

To address these questions, the study draws on survey data from 173 procurement professionals in Finland and The Netherlands. Using Partial Least Squares Structural Equation Modeling with a consistent estimator (PLSc-SEM), the study examines the relationships between competence development mechanisms, competence levels and procurement performance outcomes. In addition, a complementary Necessary Condition Analysis (NCA; [Dul, 2016](#)) examines whether the hypothesized predictors are not only contributors that increase outcomes on average but also necessary conditions whose

minimum levels must be in place before high competence and performance levels can be reached.

The findings generate both confirming and non-obvious patterns. Relational competences show the broadest positive associations across the three performance dimensions, especially innovation and operational performance. Procedural competences, despite supporting sustainability and operational performance, show a slight negative association with innovation, reflecting a compliance–innovation tradeoff that is particularly salient in heavily regulated public sector settings. Enabling competences do not have direct performance effects but show very strong associations with procedural and relational competences, empirically supporting their role as meta-level, foundational capabilities rather than direct performance drivers, a relationship previously theorized but not quantitatively tested. With respect to competence development, direct mechanisms show substantially stronger associations with competence levels than indirect mechanisms, with effect sizes three to four times larger for procedural and enabling competences. The NCA complements this picture: enabling competences emerge as a necessary condition for procedural and relational competences and innovation performance presupposes a minimum level of relational competences, whereas operational performance is not constrained by any competence category.

These findings contribute to prior research on procurement competences in purchasing and supply management (e.g. [Bals et al., 2019](#); [Stek and Schiele, 2021](#)) and to the emerging literature on competences and capabilities in public procurement (e.g. [Holma et al., 2022](#); [Santos and Cabral, 2022](#); [Taheriruh et al., 2025](#)), by providing empirical evidence on how competence categories and development mechanisms jointly relate to performance outcomes. In doing so, the study moves beyond identifying what competences are needed and instead shows how competences are developed and how they operate in relation to different performance dimensions in public procurement.

2. Literature background

2.1 Strategic public procurement and performance outcomes

Public procurement has significant potential to contribute to societal value, including improved public services, infrastructure and policy outcomes ([Cabral et al., 2019](#)). Traditionally, the primary emphasis of public procurement has traditionally been on ensuring cost-effectiveness, ([Malacina et al., 2022](#)), the potential of public procurement to go beyond these traditional objectives has increasingly been recognized. In particular, procurement has been positioned as a tool that can contribute to wider outcomes such as innovation and sustainability ([Berg et al., 2022](#); [Selviaridis, 2021](#)). This expanded role reflects a broader understanding of procurement as not only an administrative function but also a policy instrument ([Harland et al., 2021](#); [Taheriruh and Moshtari, 2024](#)).

Realizing strategic goals in public procurement requires professionals capable of navigating complex tradeoffs between operational and strategic goals ([Loijas et al., 2024](#)). These objectives may also create tensions, as procurement professionals must balance compliance, cost-efficiency and accountability with the flexibility, experimentation and collaboration often needed for innovation and sustainability ([Cabral, 2017](#); [Taheriruh, 2026](#)). In this context, individual competences have become essential for translating policy ambitions into strategic procurement outcomes like sustainability ([Berg et al., 2022](#)) and innovation ([Taheriruh et al., 2025](#)). Drawing on prior studies of the aims of public procurement ([Malacina et al., 2022](#)), this study focuses on three key performance indicators used to capture public procurement outcomes.

First, public procurement has historically been centered on operational and administrative objectives, with operational performance forming the core of procurement activities. The emphasis has been on compliance, cost-efficiency and process reliability, reflecting the need to ensure value for money and accountability in public spending (Grandia and Meehan, 2017; Rokkan and Haugland, 2022). Accordingly, the first performance indicator used in this study is as follows:

- *Operational performance*, referring to cost-effectiveness, process efficiency and regulatory compliance.

Moreover, innovation has increasingly become a central goal, with public procurement positioned as a vital policy tool to stimulate new solutions and markets (Johnsen et al., 2022; Taheriruh, 2026). In Europe, instruments such as public procurement of innovation and pre-commercial procurement have been introduced to support this role (Dimitri, 2020; Laari-Salmela et al., 2025). At the same time, innovation in procurement is also understood more broadly as the adoption of novel solutions and processes (Holma et al., 2022; Taheriruh et al., 2025). Based on this, the second performance indicator used in this study is as follows:

- *Innovation performance*, referring to the procurement of novel solutions, products or processes.

Likewise, sustainability objectives are increasingly embedded in public procurement practices. In this research, sustainable performance broadly refers to aiming for the integration of environmental and social considerations into procurement activities. This includes environmental approaches such as Green Public Procurement and related policy initiatives (e.g. the European Green Deal) (Cheng et al., 2018; Lenderink et al., 2022), as well as socially responsible public procurement, which focuses on achieving positive social outcomes (Berg et al., 2022).

Accordingly, the third performance indicator used in this study is as follows:

- *Sustainability performance*, reflecting the environmental and social impacts of procurement decisions.

While these performance indicators are analytically distinct in this research, they can overlap in practice, as innovation, sustainability and operational performance can reinforce each other (Beske-Janssen et al., 2023; Cabral, 2017). However, distinguishing them remains useful for examining how different competences relate to specific outcomes and for informing targeted competence development.

2.2 Developing competences for innovative and sustainable public procurement

To clarify our terminology, we adopt the term “competences” as a broader concept than “skills,” encompassing the practical application of knowledge and abilities (Beske-Janssen et al., 2023). Barnes and Liao (2012) define competences as the “knowledge, skills and abilities that are key to developing and realizing organizational goals.” Drawing from Loasby (1998), we also view competences as intangible resources formed through past experiences of competence development, which in turn enable future actions across networks of actors to achieve desired outcomes. This perspective aligns with the nature of public procurement, where collaboration across departments and with external partners is essential (Cabral et al., 2019; Taheriruh et al., 2025). Accordingly, competences are not viewed solely as individual attributes but as embedded within teams, public agencies and broader institutional structures. Related concepts such as “capability” (Loijas et al., 2024; Santos and Cabral, 2022) and “ability” (Holma et al., 2022), offer important conceptual tools

for understanding how competences are shaped, deployed and evolved in public sector settings.

Literature on procurement competences often draws upon various categorization models. For example, [Delamare-Le Deist and Winterton \(2005\)](#) propose a widely used typology that distinguishes between cognitive, social, functional and meta-competencies. Building on this, [Beske-Janssen et al. \(2023\)](#) and [Schulze et al. \(2019\)](#) apply the framework to identify competences relevant to innovative and sustainable procurement practices. Similarly, [Tassabehji and Moorhouse \(2008\)](#) outline categories such as technical, interpersonal, internal and external enterprise and strategic business skills. [Bals et al. \(2019\)](#), for instance, use this structure to explore emerging competences required by future procurement professionals.

While these frameworks offer valuable insights, particularly for private sector contexts, they often lack clarity in explaining how different competence categories are related and how they contribute to achieving specific procurement goals such as innovation, sustainability or operational efficiency. Building on these broader competence frameworks, [Taheriruh et al. \(2025\)](#) offer a categorization of competence deployment and development practices tailored to public procurement. This framework is particularly suitable for our study as it links competence categories to their enactment in practice and to the mechanisms through which they are developed, allowing us to examine both competence use and development within the same analytical model. The framework identifies three categories:

- (1) *Procedural competences*: These enable core procurement activities, emphasizing process efficiency and compliance. Examples include sustainability knowledge ([Cheng et al., 2018](#)), data analysis ([Karttunen et al., 2025](#)) and procedural interaction competences ([Holma et al., 2022](#); [Taponen and Kauppi, 2017](#)).
- (2) *Relational competences*: These are necessary for engaging and collaborating with suppliers and stakeholders. Examples include stakeholder management ([Cabral et al., 2019](#)), communication ([Beske-Janssen et al., 2023](#)) and networking ([Stek and Schiele, 2021](#)).
- (3) *Enabling competences*: These support and enhance both procedural and relational competences. Examples include creativity ([Stek and Schiele, 2021](#)), leadership ([Loosemore et al., 2022](#)), change management ([Taheriruh et al., 2025](#)) and a result-oriented mindset ([Uenk and Taponen, 2020](#)).

This framework reveals the interdependence between competence types and how enabling competences play a vital role in reinforcing both procedural and relational aspects. These insights resonate with the capability literature, for example, [Santos and Cabral \(2022\)](#) illustrate how knowledge management capabilities influence bid management and stakeholder engagement, contributing to overall procurement goals. Compared to the extensive discussions on competence requirements for procurement, the topic of competence development has received considerably less attention in public procurement research ([Derwik and Hellström, 2017](#)). Much of the existing literature emphasizes identifying which competences are needed, rather than examining how they are cultivated. Traditional approaches to competence development have relied heavily on formal training programs ([Stek and Schiele, 2021](#)) and academic education ([Gámez-Pérez et al., 2020](#)). More recently, there has been a shift toward more dynamic and practice-oriented methods. These include digital, competence-based training ([Stek et al., 2025](#)), problem-based learning ([Karttunen et al., 2025](#)) and case-based learning approaches ([Kaufmann and Reimann, 2024](#)).

Recent research has also highlighted the importance of knowledge transformation processes in purchasing and supply management, emphasizing how knowledge is created,

shared and embedded within organizations to support competence development (Kelly *et al.*, 2025). Additionally, competence development is increasingly seen as a relational process, involving interactions with external actors (Taheriruh *et al.*, 2025). For example, collaborative initiatives with suppliers (Picaud-Bello *et al.*, 2019) and intermediaries (Selviaridis *et al.*, 2023) are recognized as effective mechanisms for experiential learning.

Expanding on this relational view, we draw on the competence development dimension of the framework by Taheriruh *et al.* (2025), which distinguishes between two types of competence development practices, differentiated primarily by the *locus* of learning, whether it is organizationally driven from within or emerges through external collaboration:

- (1) *Direct competence development* refers to intentional, internally-oriented activities aimed at building competences within the organization, where the primary mechanism is deliberate instruction or practice with an explicit goal of skill acquisition. Examples include in-house training programs (Stek and Schiele, 2021), structured professional development curricula (Karttunen *et al.*, 2025) and mentoring and peer learning arrangements among colleagues (Momeni *et al.*, 2023). The key feature of direct development is organizational intentionality: competences are cultivated through planned internal activities and the knowledge gained is expected to be integrated into individuals' professional repertoires, consistent with discussions emphasizing the importance of integrating organizational knowledge into procurement practice (Kelly *et al.*, 2025).
- (2) *Indirect competence development* refers to learning that emerges as a by-product of collaboration with external actors such as suppliers (Picaud-Bello *et al.*, 2019), peer agencies (Lonsdale *et al.*, 2017) or intermediaries (Selviaridis *et al.*, 2023). In this mode, procurement professionals develop new insights, skills and problem-solving approaches through exposure to different practices and perspectives. Unlike formal training, these competences are often embedded in the external relationship itself and may require additional deliberate effort to be retained and independently applied within the organization once the collaboration concludes.

We recognize that this distinction is analytical rather than absolute. In practice, some activities may combine elements of both modes. For instance, a mentoring arrangement involving a supplier expert contains elements of both internal capacity-building and external knowledge transfer. The distinction is nonetheless theoretically meaningful, as it captures two different organizational logics for competence development: one that prioritizes planned internal investment and one that leverages external networks as learning environments. By holding these two mechanisms analytically distinct, we can examine empirically whether and how each contributes to the development of the three studied competence categories.

3. Hypothesis development

Building on the conceptual foundation, the next section translates these ideas into testable hypotheses. It links the three competence categories and the two development mechanisms to the key performance dimensions of public procurement, namely operational, sustainability and innovation outcomes. This study proposes a set of hypotheses linking (1) the three competence categories to procurement performance outcomes and (2) the two competence development mechanisms to the formation of these competences.

3.1 Procurement competences and performance

Public procurement professionals must manage a growing range of responsibilities that extend beyond administrative compliance to achieving strategic outcomes. The competence framework introduced earlier suggests that procedural, relational and enabling competences jointly determine how effectively individuals and organizations can meet diverse performance objectives. Prior research indicates that competences not only shape how procurement processes are executed but also influence the extent to which sustainability and innovation goals are realized (Bals *et al.*, 2019; Beske-Janssen *et al.*, 2023; Taheriruh *et al.*, 2025). Therefore, in this section, we develop hypotheses on how the three competence categories contribute to the three key performance dimensions (operational, sustainability and innovation) and explore their interrelations.

Operational performance has long been considered a fundamental aspect of public procurement, emphasizing areas such as cost, efficiency and compliance (Hakansson and Axelsson, 2020; Malacina *et al.*, 2022). Achieving these outcomes depends not only on the correct application of procurement rules and procedures, but also on effective coordination with stakeholders, as well as organizational support for consistent process execution (Loijas *et al.*, 2024; Lonsdale and le Mesurier, 2024; Santos and Cabral, 2022). Against this background, operational performance in public procurement can be understood as the outcome of the combined role of procedural, relational and enabling competences (Taheriruh *et al.*, 2025). We therefore hypothesize that higher levels of these competences are associated with stronger operational performance in public procurement:

- H1. A) Procedural competences, B) relational competences and C) enabling competences positively influence the operational performance of public organizations in public procurement.

While operational performance is foundational, public procurement has increasingly been leveraged to achieve more strategic outcomes such as sustainability (Cheng *et al.*, 2018). While much of the existing research on procurement competences has been conducted in the private sector (Beske-Janssen *et al.*, 2023; Schulze *et al.*, 2019), these insights can be extended to public procurement settings. Traditional procurement and sustainable procurement differ, but sustainability must be integrated into all procurement processes rather than isolated as distinct tasks (Johnsen *et al.*, 2022). Research suggests that competences required for sustainable procurement include not only technical and cognitive knowledge but also relationship-building and meta-oriented competences (Schulze *et al.*, 2019). These competences support sustainability-driven procurement processes, particularly in supplier relationships, enabling organizations to effectively achieve sustainability goals (Beske-Janssen *et al.*, 2023). Drawing from these findings, we hypothesize that the three studied competence categories positively influence sustainability performance in public procurement:

- H2. A) Procedural competences, B) relational competences and C) enabling competences positively influence the sustainability performance of public organizations in public procurement.

Similarly, procurement competences are essential for fostering innovation, with much of the prior research focusing on the private sector (Beske-Janssen *et al.*, 2023). Innovation-oriented procurement requires moving beyond standardized routines toward practices that allow experimentation, learning and interaction over time (Johnsen *et al.*, 2022). Studies emphasize the importance of creativity imagination and collaboration as critical

competences for driving innovation within procurement (Picaud-Bello *et al.*, 2019; Stek *et al.*, 2025; Stek and Schiele, 2021). While these studies focus on procurement in general, we draw on their findings to argue that high level of all the three studied competences can significantly enhance innovative performance in public procurement organizations. Based on the literature, public procurement actors must be able to work with procurement procedures that allow flexibility and dialogue (Holma *et al.*, 2022), collaborate closely with suppliers and other stakeholders (Santos and Cabral, 2022) and operate in organizational environments that tolerate uncertainty and support learning (Taheriruh *et al.*, 2025).

Taken together, these insights suggest that innovation performance in public procurement depends on the combined role of procedural competences that allow learning-oriented procurement processes, relational competences that foster collaboration and creativity and enabling competences that support risk-taking and organizational learning. We therefore hypothesize that higher levels of these competences are associated with stronger innovation performance in public procurement:

- H3. A) Procedural competences, B) relational competences and C) enabling competences positively influence the innovation performance of public organizations in public procurement.

In addition to their direct relationship with performance outcomes, enabling competences play a foundational role in shaping how other procurement competences develop. Enabling competences, such as knowledge management, are critical in supporting and enhancing procedural and relational competences in public procurement (Taheriruh *et al.*, 2025). For instance, Santos and Cabral (2022) show that knowledge management enables bid management and stakeholder engagement, which are central to the effective deployment of procedural and relational competences in public procurement. Thus, we hypothesize that enabling competences positively influence procedural and relational competences in public organizations:

- H4. The level of enabling competences is positively related to the level of a) procedural competences and b) relational competences in public organizations.

3.2 Competence development and competences

Compared to the extensive literature on procurement competence requirements, considerably less attention has been paid to how such competences are developed in public procurement organizations (Derwik and Hellström, 2017). To provide a more comprehensive perspective, this study examines how direct and indirect competence development mechanisms are associated with the three main competence categories. Competences are therefore treated as outcomes of past learning and development activities, some of which can be understood as deliberate competence development practices.

Prior research has predominantly emphasized direct competence development approaches, such as formal training and academic education, as key mechanisms for developing procurement competences (Stek and Schiele, 2021; Gámez-Pérez *et al.*, 2020). These activities enable individuals and teams to acquire new knowledge and skills that can be integrated into organizational practices. Building on this view, direct competence development activities are expected to contribute to the development of procedural, relational and enabling competences within public procurement organizations. Accordingly, we propose:

- H5. Direct competence development activities positively influence the development of a) procedural competences, b) relational competences and c) enabling competences in public organizations.

In addition to direct methods, the exploration of new competences through external engagements has also been highlighted ([Momeni et al., 2023](#)). Previous research has shown the value of supplier interactions, such as market dialogues ([Holma et al., 2022](#)), as mechanisms to acquire procurement competences. From this perspective, indirect competence development occurs through interaction with external actors, such as suppliers, peer organizations and intermediaries, where learning takes place through collaboration, experimentation and exposure to new practices rather than through formal instruction ([Taheriruh et al., 2025](#)). Therefore, we propose:

- H6. Indirect competence development activities positively influence the development of a) procedural competences, b) relational competences and c) enabling competences in public organizations.

[Figure 1](#) illustrates the proposed research model and hypotheses. The proposed research model highlights the relationships among competence development, competences and performance constructs. In the model, competence development influences the development of competences, which in turn affect performance outcomes. Additionally, enabling competences are shown to impact the other two competence categories, reflecting how this construct is defined as foundational to the overall framework. The details of the survey items can also be found in [Appendix 1](#).

4. Methodology

4.1 Research context and methods

This study collected data through a survey conducted as part of a broader EU-funded research and development project focusing on public procurement, with particular attention to innovation- and sustainability-related competences. The survey data used in this article specifically target public procurement professionals working in national and local public organizations in Finland and The Netherlands and data were collected between March and October 2024. Out of 1,398 distributed surveys, 173 usable responses were received, reflecting a 12% response rate. Respondents were reached through professional procurement networks and organizational communication channels coordinated by project partner institutions. Participation was voluntary and anonymous and no incentives were provided. The survey link was distributed digitally and remained open from March to October 2024. To ensure that responses reflected actual procurement practice, respondents who indicated that they had no involvement in procurement-related tasks were removed from the data set. This approach follows common practice in survey-based public procurement research, where professional association and network-based sampling frames are used to capture experienced practitioner perspectives (e.g. [Grandia and Meehan, 2017](#); [Loosemore et al., 2022](#)). The final sample of 173 usable responses therefore represents practicing procurement professionals with direct experience in procurement decision-making and competence development activities. The survey captured data on professionals' competencies, competence development methods and perceptions of their organizations' operational, innovation and sustainability performance, forming the basis for the analysis.

Finland and the Netherlands provide a particularly relevant context for examining competences for innovative and sustainable public procurement. Both countries are recognized as relatively mature procurement systems within the European Union, with long-

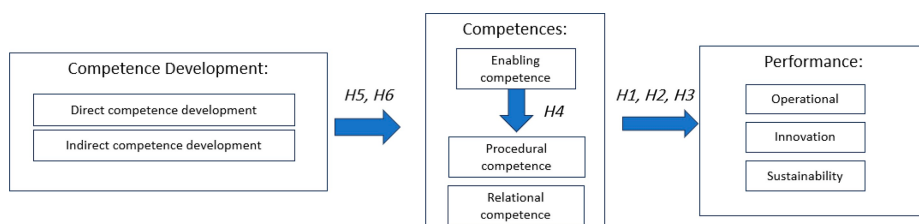


Figure 1. Illustration of the research framework

Source: Authors' own work

standing policy commitments to strategic, innovation-oriented and sustainability-oriented procurement, as well as professionalization of the public procurement function (e.g. Malacina *et al.*, 2022; Karttunen *et al.*, 2024). In both settings, procurement professionals typically operate under comparatively high procedural transparency and legal scrutiny but also enjoy a degree of autonomy in designing procedures, conducting market dialogues and engaging suppliers. These institutional conditions create a demanding competence environment: professionals must combine strong procedural and legal knowledge with the relational and enabling competences needed to work across organizational boundaries, coordinate stakeholders and co-create solutions with suppliers. As such, Finland and The Netherlands constitute advanced cases where competence requirements for innovative and sustainable public procurement are likely to be pronounced, while still offering variation in organizational size, sector and mandate that supports analytical generalization to other European public procurement systems.

Constructs were measured using a multi-item questionnaire based on established scales, with responses captured on a five-point Likert scale. Competence items were assessed using the scale (1 = “No competence,” 5 = “I could train others”), reflecting respondents’ self-evaluated proficiency levels. Items measuring competence development mechanisms and perceived individual or organizational performance used agreement-based statements rated on a five-point scale (1 = “Strongly disagree,” 5 = “Strongly agree”). This dual-scale design allowed respondents to distinguish between their skill proficiency and their evaluative perceptions of development activities and performance outcomes (see Appendix 1). This format, commonly used in Partial Least Square-Structural Equation Modeling (PLS-SEM) studies (Hair *et al.*, 2011), balances granularity and simplicity, reducing cognitive load while maintaining reliability (Dawes, 2008) and minimizing central tendency bias, enhancing result comparability (Hartley, 2014). PLS-SEM has been increasingly adopted as an analytical method in public procurement research (Changalima *et al.*, 2026). Given the complexity of the research model and the characteristics of the data, PLS-SEM with a consistent estimator (PLSc) is suitable for models with multiple latent constructs and numerous structural paths, especially when the primary aim is to explain variance and explore theoretically grounded but relatively under-tested relationships, as is the case for competence development in public procurement (Hair *et al.*, 2011; Sarstedt *et al.*, 2023). Our sample size of 173 respondents is moderate relative to the number of constructs and paths in the model, which further supports the use of PLSc-SEM, as it is less demanding in terms of distributional assumptions and sample size than covariance-based SEM. In addition, preliminary checks indicated deviations from multivariate normality, making a distribution-free approach appropriate. The use of the PLSc estimator ensures consistent parameter estimates for reflective constructs, aligning the advantages of PLS with the interpretability of

covariance-based structural models. We also assessed the model's predictive relevance using Stone–Geisser's Q^2 , with all endogenous constructs exhibiting Q^2 values above zero, indicating meaningful out-of-sample predictive capability. All analyses were conducted using SmartPLS 4 (Ringle *et al.*, 2024).

To complement the sufficiency logic of the structural model with a necessity perspective, we additionally conducted a NCA (Dul, 2016), following the guidelines for the combined use of PLS-SEM and NCA (Richter *et al.*, 2020), an approach supported in SmartPLS 4. NCA examines whether a minimum level of a condition is required for a given outcome level, a question that regression-based estimates cannot answer (Dul, 2016; Vis and Dul, 2018). The analysis was performed on the latent variable scores of the eight constructs, rescaled to the original five-point metric for interpretability. For each of the seventeen hypothesized condition-outcome relationships, we estimated CE-FDH and CR-FDH ceiling lines, computed the necessity effect size d and assessed statistical significance with the approximate permutation test using 10,000 permutations (Dul *et al.*, 2020). Following Dul *et al.* (2020), we interpret a condition as a meaningful necessary condition only if $d \geq 0.1$ and $p < 0.05$. The complete NCA results, including bottleneck tables and ceiling plots, are reported in Appendix 3.

4.2 Measurement of research constructs

The questionnaire was developed through a multi-step process. In the first step, the constructs and their associated items were developed based on the literature discussed in the background and hypothesis development sections, with particular emphasis on the framework proposed by Taheriruh *et al.* (2025). This framework informed both the competence categories, procedural, relational and enabling and the distinction between competence development mechanisms, direct and indirect competence development.

In the second step, the draft questionnaire was reviewed collaboratively within the project team through a series of online focus meetings dedicated to survey development (approximately two hours each). During these discussions, the authors and project collaborators examined each item and the overall structure of the questionnaire, assessing clarity, conceptual alignment with the competence and competence development definitions and practical relevance to public procurement experts. Based on these discussions, minor wording adjustments were made to improve readability and practitioner relevance. Finally, pilot tests were conducted in both Finland and The Netherlands with small groups of procurement professionals to assess the clarity of the items and the interpretability of the scale anchors. Feedback from the pilot tests confirmed the comprehensibility of the questionnaire and informed final refinements prior to data collection. Table 1 provides an overview of how the measurement constructs and their representative domains are conceptually grounded in prior literature. Descriptive statistics and bivariate Spearman correlations among the study constructs are reported in Appendix 2.

Construct reliability and validity were subsequently assessed using standard PLS-SEM measurement evaluation procedures. Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability, while convergent validity was assessed using Average Variance Extracted (AVE). Discriminant validity was examined using both the Fornell-Larcker criterion and the Heterotrait-Monotrait ratio (HTMT). All constructs met recommended thresholds, confirming that the measurement model is conceptually and statistically sound (Hair *et al.*, 2011; Sarstedt *et al.*, 2023). Reliability and validity assessments followed established standards as indicator and internal consistency reliability, convergent and discriminant validity as proposed in guidelines by Hair *et al.* (2011) and later updated by Sarstedt *et al.* (2023).

Table 1. Conceptual mapping of constructs to prior literature

Constructs	Representation	Key references
Procedural competences	Competences related to planning, analytical work, compliance and the structured execution of procurement processes, including sustainability-related procedural knowledge	Taheriruh et al. (2025) ; Tassabehji and Moorhouse (2008) ; Cheng et al. (2018) ; Holma et al. (2022) ; Taponen and Kauppi (2017) ; Beske-Janssen et al. (2023)
Relational competences	Competences enabling communication, coordination and collaboration with suppliers and other stakeholders across procurement processes	Taheriruh et al. (2025) ; Cabral et al. (2019) ; Bals et al. (2019) ; Stek and Schiele (2021) ; Beske-Janssen et al. (2023) ; Santos and Cabral (2022)
Enabling competences	Foundational competences that support learning, adaptability, leadership and the effective deployment of other procurement competences	Taheriruh et al. (2025) ; Stek and Schiele (2021) ; Loosemore et al. (2022) ; Uenk and Taponen (2020)
Operational performance	Outcomes related to cost efficiency, process effectiveness and regulatory compliance in public procurement	Hesping and Schiele (2015) ; Malacina et al. (2022)
Sustainability performance	Outcomes reflecting environmental and social impacts of procurement activities	Cheng et al. (2018) ; Hesping and Schiele (2015) ; Malacina et al. (2022) ; Lenderink et al. (2022)
Innovation performance	Outcomes related to the procurement of novel solutions and innovation-oriented procurement processes	Hesping and Schiele (2015) ; Johnsen et al. (2022) ; Malacina et al. (2022)
Direct competence development	Internal activities aimed at developing procurement competences through training, structured learning and experiential practice	Taheriruh et al. (2025) ; Stek and Schiele (2021) ; Gámez-Pérez et al. (2020) ; Santos and Cabral (2022) ; Karttunen et al. (2025)
Indirect competence development	Competence development through interaction and learning with external actors such as suppliers, peer organizations and intermediaries	Taheriruh et al. (2025) ; Momeni et al. (2023) ; Holma et al. (2022) ; Selviaridis et al. (2023)

Source(s): Authors' own work

4.3 Data sample

[Table 2](#) shows that the surveyed procurement professionals ($n = 173$) display a broad range of experience, from newcomers (0 years) to highly seasoned experts (30 years). On average, respondents have 8.5 years of procurement experience, with the median at 7 years. The distribution is right-skewed, as indicated by a 75th percentile of 12 years and a maximum of 30 years. In terms of organizational size, the average number of employees is about 2,892, but the high standard deviation (5,764.57) suggests substantial variability across respondents' institutions. Some are very small organizations with as few as two employees, whereas others are extremely large with up to 38,000 employees. [Appendix 2 \(Table A1\)](#) reports construct-level descriptive statistics and Spearman correlations. The pattern is broadly consistent with the paper's theorizing: the three competence dimensions correlate

Table 2. Descriptive statistics of the sample

Measure	Respondent experience (in years)	Employees in the organization
Count	173	173
Mean	8.5	2892
Std	6.933	5764.57
Min	0	2
25%	3	80
50%	7	450
75%	12	3800
Max	30	38000

Source(s): Authors’ own work

moderately with each other and show positive associations with operational and sustainability performance, while direct and indirect competence development are strongly interrelated and positively related to the competence constructs. Importantly for the PLSc analysis, the correlations remain below conventional “red flag” thresholds (i.e. no near-unity relationships), suggesting no obvious multicollinearity and supporting the treatment of these constructs as empirically distinct prior to the model-based (PLSc) assessment of the measurement and structural relationships.

Moving to the nature of purchasing activity (Table 3), the majority of respondents purchase a balance of both standardized and customized offerings, with 42.48% indicating this split. Similarly, about 42.03% handle a fairly even mix of physical products and services. Still, a subset focuses mostly on customized or mostly on services, reflecting the diverse procurement mandates in different public agencies. Overall, the sample captures a spectrum of procurement contexts, from smaller offices dealing with narrower product ranges to larger organizations balancing varied purchasing portfolios.

4.4 Measurement model assessment

Construct reliability and validity were assessed following established guidelines (Hair et al., 2011; Sarstedt et al., 2023). Table 4 presents the Cronbach’s alpha, composite reliability (ρ_c) and AVE for all constructs. Direct Competence Development, Indirect Competence Development, Procedural Competences, Relational Competences and the three performance constructs each surpass the commonly accepted thresholds of $\alpha \geq 0.70$ and $AVE \geq 0.50$, indicating robust internal consistency and convergent validity. Enabling Competences registers Cronbach’s alpha of 0.694, which is marginally below the conventional 0.70

Table 3. Share of products purchased by respondents

Type of products purchased (%)		Share of physical products or services purchased (%)	
Only standardized	2.38	Only physical products	1.12
Mostly standardized	33.33	Mainly physical products, fewer services	14.08
Balance of standardized and customized	42.48	Balance of products and services	42.03
Mostly customized	17.83	Mainly services, fewer physical products	35.82
Only customized	3.98	Only services	6.95

Source(s): Authors’ own work

Table 4. Construct reliability and validity

Construct	Items (N)	Cronbach's alpha	Composite reliability (rho_c)	AVE
Enabling competences	3	0.694	0.83	0.62
Procedural competences	4	0.762	0.849	0.584
Relational competences	5	0.802	0.863	0.558
Operational performance	3	0.73	0.848	0.651
Innovation performance	3	0.704	0.814	0.598
Sustainability performance	4	0.755	0.845	0.58
Direct competence development	3	0.788	0.876	0.703
Indirect competence development	3	0.719	0.839	0.636

Source(s): Authors' own work

threshold. This is partly attributable to the construct's short scale (three items), as the Cronbach's alpha is sensitive to the number of indicators and systematically underestimates true reliability in short scales (Sijtsma, 2009). Importantly, composite reliability (ρ_c), which is the recommended reliability indicator in PLS-SEM and less sensitive to scale length, meets or exceeds the 0.70 threshold for this construct (Hair *et al.*, 2011; Sarstedt *et al.*, 2023). The AVE for Enabling Competences likewise meets the 0.50 convergent validity threshold and the construct demonstrates appropriate discriminant validity across all assessments. While Cronbach's alpha is marginally below the common threshold, the composite reliability indicator supports retaining the construct.

All constructs also exhibit appropriate loading patterns, with item loadings generally exceeding 0.70. These results confirm that the measurement model is reliable and valid, ensuring that subsequent structural inferences rest on a solid measurement foundation.

Next, discriminant validity was evaluated using the Fornell-Larcker criterion and HTMT ratios. The square root of each construct's AVE exceeded its inter-construct correlations; likewise, all HTMT values remained below 0.90, supporting discriminant validity (Table 5). Hence, the final measurement model is both reliable and valid, providing a robust foundation for interpreting structural relationships.

4.5 Structural model assessment

The structural model fit was evaluated through key indices and R^2 values. The SRMR (Standardized Root Mean Square Residual) for the estimated model is 0.089, which is

Table 5. Discriminant validity – Fornell-Larcker criterion

Construct	1	2	3	4	5	6	7	8
(1) Procedural competences	0.764							
(2) Relational competences	0.454	0.747						
(3) Enabling competences	0.522	0.691	0.788					
(4) Operational performance	0.382	0.463	0.373	0.807				
(5) Innovation performance	0.126	0.358	0.262	0.184	0.773			
(6) Sustainability performance	0.306	0.229	0.272	0.277	0.234	0.762		
(7) Direct competence development	0.390	0.237	0.252	0.362	0.007	0.317	0.838	
(8) Indirect competence development	0.310	0.197	0.208	0.273	0.133	0.342	0.658	0.797

Source(s): Authors' own work

slightly above the conventional cutoff of 0.08 but remains acceptable in an exploratory context. Table 6 lists the coefficients of determination, showing that Relational Competences ($R^2 = 0.482$) and Procedural Competences ($R^2 = 0.346$) are most strongly explained by their predictors. Operational Performance registers a moderate R^2 of 0.251, while Innovation Performance, Sustainability Performance and Enabling Competences exhibit lower but still notable explanatory power (0.130, 0.104 and 0.067, respectively). Overall, these findings indicate that the model has moderate to modest predictive capability for the examined constructs.

4.5.1 *Common method bias mitigation.* Several procedural steps were taken to reduce the risk of common method bias. The questionnaire was structured so that predictor constructs (competences and competence development mechanisms) were presented on separate pages from the performance outcome constructs. Separating measurement blocks reduces the likelihood that respondents infer relationships among variables during the response process (Podsakoff et al., 2003). Participation was voluntary and anonymous and respondents were informed that there were no right or wrong answers, which helps minimize evaluation apprehension and socially desirable responding (Podsakoff et al., 2003).

In addition to procedural controls, statistical tests were conducted to assess common method bias. In the Harman’s single-factor test, the first factor accounted for 28% of the total variance, which is well below the commonly accepted 50% threshold, indicating that variance is not driven by a single underlying factor. In addition, full collinearity VIF values for all latent constructs ranged between 1.32 and 2.47, remaining below the recommended upper limit of 3.3 (Kock, 2015).

4.5.2 *Level of analysis of performance measures.* The performance constructs used in this study reflect organizational- and departmental-level outcomes rather than individual performance. Respondents were considered qualified informants because all survey participants were actively engaged in public procurement activities and held roles that required awareness of procurement processes, outcomes and organizational priorities. Prior research in public procurement and supply management similarly relies on practitioner self-assessment for organizational performance constructs, as procurement professionals possess relevant experiential and contextual knowledge of procurement outcomes within their organizations (Kähkönen et al., 2025; Malacina et al., 2025).

The items measuring operational, sustainability and innovation performance were therefore framed at the organizational/departmental level and respondents were instructed to base their evaluations on observed procurement results and comparative internal benchmarks. This approach aligns with established practices in public procurement performance research, where managers and procurement professionals are considered

Table 6. Coefficients of determination

Endogenous construct	R^2	R^2 adjusted
Procedural competences	0.346	0.334
Relational competences	0.482	0.473
Enabling competences	0.067	0.056
Operational performance	0.251	0.243
Innovation performance	0.13	0.12
Sustainability performance	0.104	0.094

Source(s): Authors’ own work

5. Findings

This section presents the empirical results of the PLSc-SEM analysis, outlining the tested relationships between competence development mechanisms, individual competences and procurement performance outcomes. The analysis reports the structural model results after confirming the reliability and validity of the measurement model. Table 7 reports the path coefficients and significance tests for all hypothesized relationships and Figure 2 presents the final structural model with significant paths highlighted, illustrating the relationships between competence development activities, competence levels and procurement performance outcomes.

The results show that procedural competences show a positive effect on operational performance ($\beta=0.22$, $p<0.01$) and sustainability performance ($\beta=0.26$, $p<0.01$). Relational competences demonstrate the strongest influence among the three competence categories, with positive effects on operational performance ($\beta=0.37$, $p<0.001$) and innovation performance ($\beta=0.38$, $p<0.001$) and a smaller positive effect on sustainability performance ($\beta=0.11$, $p<0.05$). Enabling competences do not exhibit significant direct effects on performance outcomes ($p>0.10$), implying that their contribution to performance is indirect.

Enabling competences show strong positive associations with the two other competence categories. They are positively related to procedural competences ($\beta=0.45$, $p<0.001$) and even more strongly to relational competences ($\beta=0.67$, $p<0.001$). This indicates that strategic awareness, adaptability and the ability to manage complexity form the basis on which both structured process handling and collaborative abilities develop. Enabling competences therefore function as foundational competences, supporting the development

Table 7. Tested hypotheses summary

<i>H</i>	Hypothesized path	Path coefficient	<i>t</i> -statistics	<i>p</i> -value	95% CI (lower, upper)
<i>H1a</i>	Procedural C. → operational P.	0.216 (**)	3.21	0.001	[0.084; 0.348]
<i>H1b</i>	Relational C. → operational P.	0.365 (***)	4.15	0.000	[0.193; 0.537]
<i>H1c</i>	Enabling C. → operational P.	0.146	0.74	0.458	[0.024; 0.333]
<i>H2a</i>	Procedural C. → sustainability P.	0.255 (**)	2.86	0.005	[0.080; 0.430]
<i>H2b</i>	Relational C. → sustainability P.	0.114 (*)	1.99	0.047	[0.082; 0.226]
<i>H2c</i>	Enabling C. → sustainability P.	0.212	1.11	0.267	[0.162; 0.486]
<i>H3a</i>	Procedural C. → innovation P.	−0.046	1.72	0.085	[−0.098; 0.006]
<i>H3b</i>	Relational C. → innovation P.	0.379 (***)	4.33	0.000	[0.207; 0.551]
<i>H3c</i>	Enabling C. → innovation P.	0.012	1.68	0.094	[0.012; 0.026]
<i>H4a</i>	Enabling C. → procedural C.	0.449 (***)	4.76	0.000	[0.264; 0.634]
<i>H4b</i>	Enabling C. → relational C.	0.673 (***)	6.15	0.000	[0.459; 0.887]
<i>H5a</i>	Direct CD → enabling C	0.202 (**)	2.63	0.009	[0.051; 0.353]
<i>H5b</i>	Direct CD → procedural C	0.238 (**)	2.89	0.004	[0.077; 0.399]
<i>H5c</i>	Direct CD → relational C	0.054 (*)	1.98	0.048	[0.001; 0.107]
<i>H6a</i>	Indirect CD → enabling C	0.075 (*)	2.1	0.036	[0.005; 0.145]
<i>H6b</i>	Indirect CD → procedural C	0.06 (*)	2.05	0.041	[0.003; 0.117]
<i>H6c</i>	Indirect CD → relational C	0.021 (**)	1.54	0.012	[−0.006; 0.048]

Note(s): *t*-statistics and *p*-values are based on the PLSc bootstrapping procedure. Significance levels are denoted as follows: $p<0.05$ (*), $p<0.01$ (**), $p<0.001$ (***)

Source(s): Authors' own work

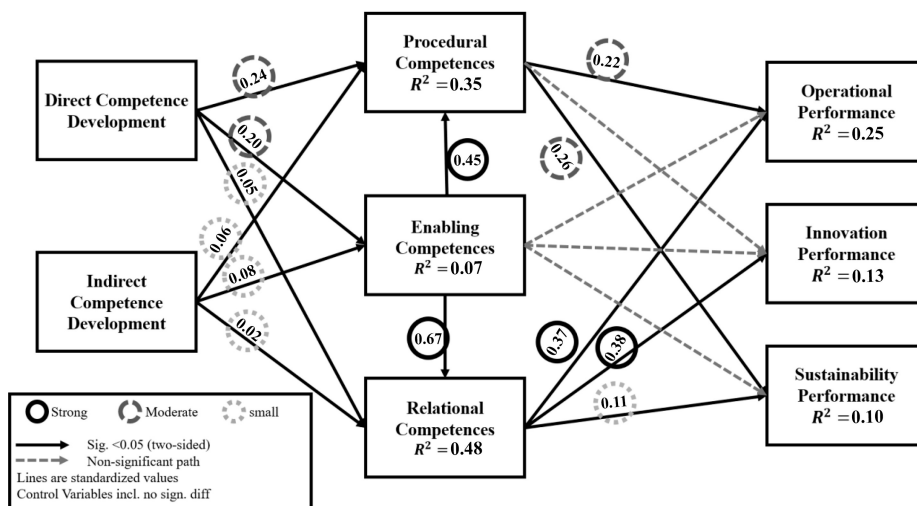


Figure 2. The results of the study

Source: Authors' own work

and expression of more task-specific and interactional capabilities, rather than directly improving performance outcomes themselves.

Both direct and indirect competence development mechanisms are connected to competence building, but the strength of effects differs. Direct competence development activities, such as learning from prior projects, internal collaboration and structured training, have a meaningful positive relationship with procedural competences ($\beta = 0.24$, $p < 0.01$) and enabling competences ($\beta = 0.20$, $p < 0.01$) and a smaller positive relationship with relational competences ($\beta = 0.05$, $p < 0.05$). This suggests that internal learning practices can be particularly effective in strengthening process-related and strategic competence dimensions.

Indirect competence development mechanisms, including collaboration with suppliers and external organizations, also have positive but smaller relationships with the studied competences ($\beta \approx 0.02$ – 0.08 , $p < 0.05$). These results suggest that external engagement contributes incrementally to competence development, but with considerably smaller effect sizes than internal learning mechanisms, which is a distinction that is analytically important even though both mechanisms reach statistical significance. Direct development effects are three to four times larger than indirect effects for procedural and enabling competences and the relationship between indirect development and relational competences ($\beta = 0.02$) approaches the boundary of statistical support. This pattern suggests that external collaboration is not, in itself, sufficient to drive substantial competence strengthening and is best understood as a complementary mechanism alongside internally-oriented learning structures.

A group comparison between the Finland and Netherlands subsamples revealed no statistically significant differences in the structural paths ($p > 0.10$), indicating that the competence–performance relationships are consistent across institutional contexts.

The complementary NCA (Appendix 3, Table A2) adds a necessity perspective to these sufficiency-based results. Enabling competences are a significant necessary condition for procedural competences ($d = 0.19$, $p < 0.001$) and relational competences ($d = 0.23$,

$p < 0.001$), indicating that high levels of the two task-related competence categories were not observed among professionals with low enabling competences. Necessity is also concentrated in the strategic performance outcomes. Sustainability performance requires minimum levels of all three competence categories (d between 0.15 and 0.24, all $p < 0.05$) and innovation performance requires relational competences ($d = 0.30$, $p < 0.001$) and enabling competences ($d = 0.24$, $p = 0.005$), although the latter effect depends on one influential high-scoring case and should be interpreted with caution. In contrast, operational performance shows no significant necessary condition and procedural competences are not necessary for innovation performance. Neither direct nor indirect competence development is a necessary condition for any competence category, indicating that no single development route is indispensable. [Figure A1 in Appendix 3](#) displays the ceiling plots for the significant necessity relationships.

The bottleneck analysis ([Appendix 3, Tables A3 to A6](#)) translates these ceilings into concrete thresholds. Achieving 80% of the observed innovation performance range requires relational and enabling competences of at least 3.4 on the five-point scale, whereas achieving 80% of the observed sustainability performance range requires lower competence levels of roughly 2.4–2.8. Similarly, achieving 80% of the observed procedural competence range requires enabling competences of at least 3.0 and achieving 80% of the observed relational competence range requires enabling competences of about 3.9.

6. Discussion

This study sets out to examine how individual competences and competence development mechanisms are related to performance outcomes in public procurement. The following section discusses these findings in relation to prior research on the use and development of procurement competences in public procurement settings.

6.1 Effects of individual competences on public procurement performance

Procedural competences, in this study, are related to operational and sustainability performance. They support compliance with legal and sustainability requirements and contribute to reliable and transparent procurement processes, for example through the structured evaluation of procurement alternatives in decision-making. This interpretation gives empirical support to public procurement studies emphasizing procedural knowledge for managing regulatory frameworks, bid management and pre-tender market dialogues ([Holma et al., 2022](#); [Santos and Cabral, 2022](#)) and resonates with the procedural competence dimension proposed by [Taheriruh et al. \(2025\)](#), alongside competence frameworks highlighting technical and functional dimensions ([Tassabehji and Moorhouse, 2008](#); [van Weele and van Raaij, 2014](#)). At the same time, the non-significant and slightly negative association between procedural competences and innovation observed in this study reflects a familiar tension in public procurement, whereby extensive proceduralizing may limit flexibility for experimentation and exploratory collaboration ([Edler and Yeow, 2016](#); [Uyarra et al., 2014](#)). In contexts characterized by strong compliance demands and auditability, procedural competences appear to strengthen predictability and accountability but may reduce organizational tolerance for risk, iteration and supplier-driven solution development ([Caldwell et al., 2009](#); [Uyarra et al., 2014](#)). Innovation therefore appears, in this study, to benefit when procedural competences are combined with other competence categories rather than further intensified in isolation ([Santos and Cabral, 2022](#); [Uyarra et al., 2020](#)).

Relational competences, in this study, are related to innovation and operational performance by supporting interaction and collaboration with suppliers and other stakeholders, for example through clear communication of objectives and joint adjustment of

development activities during contract implementation. This finding aligns with the interaction-oriented competence perspective proposed by [Taheriruh et al. \(2025\)](#) and with prior research highlighting the importance of stakeholder engagement, cross-functional collaboration and buyer–supplier interaction in innovative procurement ([Uyarra et al., 2014](#); [Holma et al., 2022](#)). In practical terms, these competences are reflected in clear communication of objectives to suppliers, ongoing dialogue during contract implementation and the ability to adjust development activities jointly with partners. From a network perspective, relational competences appear to enable public organizations to translate procurement goals into coordinated action across organizational boundaries ([Spring and Araujo, 2014](#)). At the same time, under public-sector conditions characterized by strict regulation and heightened accountability, the effective deployment of relational competences observed in this study remains closely intertwined with procedural requirements, reinforcing the importance of considering how interaction and formal structures coexist in public procurement settings.

Enabling competences, such as change management, risk-taking and big-picture thinking, do not show direct significant associations with performance outcomes but are strongly related to procedural and relational competences. This pattern is theoretically coherent and aligns with [Taheriruh et al. \(2025\)](#), who conceptualize enabling competences as foundational competences that support the deployment of procedural and relational competences. In line with this, enabling competences show strong effects on procedural competences ($\beta = 0.45$, $p < 0.001$) and relational competences ($\beta = 0.67$, $p < 0.001$). In complex multi-predictor models, indirect contributions may remain significant even when direct effects do not ([Hair et al., 2011](#)). The positive confidence interval for the operational performance path [0.024; 0.333] also suggests a stable positive direction that may emerge more clearly in larger or longitudinal studies. Overall, the findings support prior arguments that enabling competences function as meta-level capabilities that facilitate the deployment of procedural and relational competences rather than acting as direct performance drivers ([Spring and Araujo, 2014](#); [Santos and Cabral, 2022](#)). The necessity analysis sharpens this interpretation. Enabling competences are a significant necessary condition for both procedural and relational competences and the bottleneck analysis shows that high levels of the two task-related categories are only reached at enabling competence thresholds of about 3.0 and 3.9 on the five-point scale ([Appendix 3](#)). The foundational role that the framework of [Taheriruh et al. \(2025\)](#) assigns to enabling competences is thus visible not only in strong average associations but also in a binding minimum requirement. Enabling competences are best characterized as necessary but not directly sufficient for performance. In other words, they do not add to performance on their own, yet without them the competences that do drive performance cannot fully develop.

Together, these patterns align with earlier comparative insights: while private-sector studies often foreground relational capabilities, public procurement elevates procedural competences due to stricter regulatory demands; even so, performance in innovative public procurement depends on how procedural, relational and enabling competences are connected rather than considered in isolation ([Holma et al., 2022](#); [Lindkvist et al., 2023](#); [Malacina et al., 2022](#)). It is also worth noting that the mixed pattern of results across the three competence categories, including paths that reach significance at different levels and one path that is directionally negative. This constitutes an interesting finding in itself, rather than a methodological limitation. Uniform positive associations across all hypothesized paths would be more consistent with common method variance inflating results than with a theoretically coherent model ([Podsakoff et al., 2003](#)). The slight negative association between procedural competences and innovation performance ($\beta = -0.046$, $p = 0.085$, $CI =$

[-0.098; 0.006]), for example, is directionally aligned with established arguments in the literature on the tension between compliance regimes and innovation-oriented procurement (Uyarra *et al.*, 2014; Edler and Yeow, 2016) and its confidence interval is almost entirely on the negative side. Similarly, the non-significant paths between enabling competence and performances are consistent with the theoretical positioning of enabling competences as foundational and indirect contributors to performance.

To conclude, these patterns suggest an outcome-specific logic in how competences operate in public procurement: relational competences function as broadly applicable contributors across performance dimensions, whereas procedural and enabling competences operate in more constrained and context-dependent ways. This differentiated profile raises the theoretical possibility that different procurement performance objectives may require different competence investments and that over-investment in procedural competences, without strong relational and enabling foundations, may create institutional inertia that constrains the very innovation that procurement policy increasingly demands. The necessity results reinforce this outcome-specific logic. Operational performance is not constrained by any minimum competence level, which is consistent with its routine and compliance-oriented character. Sustainability performance requires moderate minimum levels of all three competence categories and innovation performance presupposes relational competences of at least a mid-range level. For innovation performance, relational competences therefore act not only as the strongest average contributor but also as a bottleneck: shortfalls cannot be compensated by procedural expertise, which further underlines that innovation in public procurement depends on how competence categories work together.

6.2 Competence development connection to the level of individual competences

The second research question is addressed by examining how direct and indirect competence development mechanisms are related to the level of individual competences. The results indicate that both development mechanisms are positively related to procedural, relational and enabling competences, although the observed effects are generally moderate or small in magnitude.

Direct competence development is, in this study, significantly but moderately related to the level of procedural and enabling competences. This pattern suggests that internally oriented learning processes – such as learning from previous projects, internal collaboration and reflective practices – are particularly important for shaping current levels of competences that are closely tied to structured work processes (Taheriruh *et al.*, 2025) and strategic competences (Stek and Schiele, 2021). The importance of direct competence development practices observed in this study gives empirical support to prior research emphasizing the role of training and formal learning opportunities in public procurement (Lindfors *et al.*, 2025), as well as the support of experts and peers in facilitating learning and sensemaking (Berg *et al.*, 2022). In relation to the finding, benchmarking and the use of existing tendering documents have also been shown to support the development of key aspects of public procurement practice, such as compliance, procedural knowledge and the application of evaluation criteria (Karttunen *et al.*, 2025). At the same time, the weaker association between direct development mechanisms and relational competences present in the findings of this study suggests that interactional competences may be less readily developed through internally focused learning alone.

Indirect competence development is also significantly related to competence levels in this study, but with smaller effect sizes. Externally oriented development activities – such as collaboration with suppliers and joint development projects – have been widely discussed in the literature as important sources of learning in public procurement, as they expose

procurement professionals to new practices, perspectives and problem-solving approaches beyond organizational boundaries (Taheriruh *et al.*, 2025). This finding gives empirical support to prior research highlighting market dialogues (Berg *et al.*, 2022; Holma *et al.*, 2022) and co-creation with suppliers in innovation- and RandD-oriented projects as key mechanisms for competence transfer and adaptation (Selviaridis, 2021). Although prior research and the hypotheses of this study suggest stronger links between indirect competence development and relational competences (Taheriruh *et al.*, 2025), the statistically significant but small effects observed indicate that the benefits of externally oriented development practices may take time to be reflected in individuals' assessments of their own competence levels.

Comparing the two mechanisms, direct competence development shows substantially stronger associations with procedural competences ($\beta = 0.24$, $p < 0.01$) and enabling competences ($\beta = 0.20$, $p < 0.01$), whereas indirect development shows weaker relationships across all competence categories ($\beta = 0.02\text{--}0.08$, $p < 0.05$). Direct development effects are approximately three to four times larger, indicating a practically meaningful difference. The weakest relationship concerns indirect development and relational competences ($\beta = 0.02$), where the confidence interval includes zero, suggesting only marginal support. Overall, these findings support the analytical distinction between the two mechanisms: internally oriented learning appears more influential in shaping competence levels, while external collaboration plays a more supportive and context-dependent role.

The necessity perspective adds an important qualification to this comparison. Neither direct nor indirect competence development is a necessary condition for any competence category (Appendix 3). Competence development in public procurement thus appears equifinal: structured internal learning is the most effective route, as the sufficiency results show, but its absence does not preclude competence, which professionals may also build through prior experience, informal learning or recruitment. For the practical question of where to start, the two analyses point in the same direction. Because enabling competences are a necessary condition for the other competence categories, developing them first relaxes the binding constraint and direct competence development activities are the most effective mechanism for doing so.

7. Conclusions

7.1 Theoretical implications

This study advances understanding of how individual-level competences are enacted and developed within the institutional context of public procurement. Drawing on the public procurement competence framework proposed by Taheriruh *et al.* (2025), the study contributes to the broader literature on procurement competences and skills (e.g. Delamare-Le Deist and Winterton, 2005; Tassabehji and Moorhouse, 2008; Bals *et al.*, 2019), as well as to the growing literature on competences and capabilities in public procurement (Holma *et al.*, 2022; Loijas *et al.*, 2024). The study makes four main theoretical contributions.

First, the study contributes by empirically testing individual-level competence categories in a field that has been largely qualitative and exploratory. Prior research on individual competences in PSM (e.g. Bals *et al.*, 2019; Schulze *et al.*, 2019) and on competences and capabilities in public procurement (e.g. Holma *et al.*, 2022; Santos and Cabral, 2022; Loijas *et al.*, 2024; Taheriruh *et al.*, 2025) has predominantly relied on qualitative designs, leaving empirical testing of competence category models at the individual level limited (Stek and Schiele, 2021). By quantitatively operationalizing and testing procedural, relational and enabling competences through a survey design, this study responds to calls for stronger empirical grounding of competence frameworks in public procurement research.

Second, the study advances the literature by offering a more holistic view of individual competences, linking competence categories to both competence development mechanisms and multiple performance dimensions. Existing research has often examined competences in relation to single performance objectives – such as sustainability (Schulze *et al.*, 2019), innovation (Selviaridis, 2021) or general outcomes – while rarely integrating multiple performance dimensions within a single analytical model. Moreover, much of the literature has focused on identifying competence categories (“what to develop”) (Bals *et al.*, 2019; Stek and Schiele, 2021), rather than examining how competences are developed. By explicitly incorporating competence development mechanisms, this study complements emerging work on learning and development in public procurement (Karttunen *et al.*, 2025) and moves beyond training-centric perspectives.

Third, the study contributes by introducing an individual-level perspective into competence research in public procurement, which has predominantly focused on organizational- or relationship-level capabilities (Holma *et al.*, 2022; Santos and Cabral, 2022; Loijas *et al.*, 2024). By focusing on individuals’ perceived competence levels and their performance contributions, the study adds an important analytical layer for understanding how public procurement competences are enacted and developed in practice. This perspective also helps explain how competent public buyers may emerge as procurement champions within public organizations, extending prior work on the role of individual actors in driving procurement-related change and value creation (Loosemore *et al.*, 2022).

Fourth, the study advances theory by revealing a set of outcome-specific and counter-intuitive empirical patterns that qualify and extend prior claims about the role of competences in procurement performance. Specifically, the finding that procedural competences are positively associated with sustainability and operational performance but show a slight negative association with innovation – with a confidence interval predominantly below zero – is not derivable from prior competence literature, which generally treats competences as uniformly positive contributors. This finding provides quantitative support for arguments that regulatory and compliance demands in public sector settings may constrain innovation-oriented behavior even among highly competent individuals (Uyarra *et al.*, 2014; Edler and Yeow, 2016) and raises theoretical questions about whether the design of procurement procedures can moderate this tradeoff. Equally, the finding that enabling competences have no direct performance effects but exceptionally strong associations with both other competence categories ($\beta = 0.45$ and $\beta = 0.67$) empirically resolves a theoretical ambiguity about whether enabling competences “add” to performance independently or function exclusively as structural preconditions for other competences to operate effectively. The results clearly support the latter, refining the theoretical model and offering a precise empirical basis for the “foundational” characterization of this competence type. Finally, the asymmetry in effect sizes between direct and indirect competence development – with direct mechanisms three to four times more influential – challenges the emerging tendency in procurement education and capability-building discourse to treat external collaboration as an equivalent substitute for internal learning investment (Taheriruh *et al.*, 2025). The complementary necessity analysis extends this contribution by showing that the foundational character of enabling competences has a precise dual meaning: they are largely redundant as direct performance drivers but necessary for the competences that do drive performance. It also qualifies the role of development mechanisms, which are effective but not indispensable routes to competence improvement. Distinguishing between necessary and sufficient competence conditions thereby offers a more differentiated theoretical vocabulary for competence research in public procurement than average effect sizes alone.

7.2 Practical implications

The findings have several practical suggestions for public organizations aiming to improve the contribution of procurement to innovation, sustainability and operational outcomes. Given the moderate and small effect sizes observed in some relationships, these suggestions should be seen as focused areas for improvement rather than one-size-fits-all solutions.

First, the results indicate that procedural competence remains essential for embedding sustainability and maintaining operational efficiency, especially in environments where procurement is highly regulated. Efforts to update procurement guidelines, develop templates for sustainability-aligned specifications and integrate multi-criteria evaluation tools can help ensure that procedural expertise supports sustainability ambitions rather than reinforcing cost-driven decisions.

Second, relational competences are particularly influential in driving innovation and supporting operational performance. Public organizations should therefore prioritize competence development initiatives that strengthen communication, negotiation and stakeholder engagement skills. This includes training in how to conduct market dialogues, facilitate cross-department coordination and maintain constructive supplier relationships throughout the contract lifecycle. In practice, strengthening these competences can help procurement professionals work more effectively with suppliers to develop and implement new solutions.

Third, the finding that enabling competences support both procedural and relational competences suggest that developing strategic and adaptive thinking skills can have a multiplying effect. Leadership development programs, reflective learning sessions and involvement in complex or cross-agency procurement projects can help procurement professionals build the capacity to navigate uncertainty and align actors around shared objectives. These competences are particularly useful when procurement professionals need to balance competing goals and make decisions under uncertainty. The bottleneck analysis in [Appendix 3](#) makes these priorities concrete. High procedural and relational competence levels were only observed among professionals whose enabling competences reached at least about 3.0 and 3.9 on the five-point scale, respectively and high innovation performance additionally requires relational competences of at least about 3.4. For organizations that ask where to start, enabling competences are the binding constraint and thus the natural first investment, followed by relational competence building when innovation objectives dominate. It is also notable that our findings show that innovation and sustainability performance have necessary competence conditions whereas operational performance does not. This suggests that the former performance objectives require more specific competence categories.

Fourth, the evidence demonstrates that direct competence development mechanisms, such as learning from past projects, internal collaboration and benchmarking, are effective in developing different categories of competences. Public organizations should therefore create structured spaces for shared learning, such as post-project reviews, internal procurement networks and communities of practice. In practical terms, regularly reflecting on past procurements and sharing experiences across teams can strengthen both process-related and strategic competences.

Finally, external collaboration practices with suppliers, such as market dialogues and innovation partnerships, provide access to knowledge and perspectives that may not be available inside the organization. However, given the smaller observed effects, these practices should complement rather than replace structured internal learning. These mechanisms should be used strategically, for example by involving suppliers early in needs

7.3 Limitations and future research

Several caveats warrant caution in interpreting our results. First, the cross-sectional nature of the survey limits causal inference, as feedback loops may exist between competence levels and performance outcomes. In addition, the study identifies relationships between competence development activities and competence levels, but cannot demonstrate actual competence improvement over time. A further limitation concerns the use of self-reported measures from single informants, which may introduce common method and social desirability bias despite the procedural and statistical remedies applied. However, the presence of non-significant and slightly negative relationships suggests that the findings are unlikely to be driven solely by common method inflation. Self-reported competence assessment is also an established approach in procurement competence research (Bals *et al.*, 2019; Stek and Schiele, 2021) and the consistency of findings across the Finnish and Dutch subsamples supports the stability of the results.

A related limitation is the exclusive reliance on perceptual performance measures. While this is consistent with prior individual-level competence research, future studies could combine survey data with organizational performance indicators where anonymity constraints permit. Combining perceptual and archival measures, for example audit outcomes, realized savings or innovation procurement statistics, would also allow testing whether the competence thresholds identified in the NCA are reflected in objectively measured performance. In addition, although the questionnaire was designed to be understandable in both country contexts, subtle differences in administrative terminology or interpretation between Finland and The Netherlands cannot be ruled out. Some relationships, particularly those involving enabling competences and innovation-oriented outcomes, may also unfold over longer time horizons than a cross-sectional design can capture.

Building on these limitations, future research could examine how innovation, sustainability and operational objectives overlap and reinforce one another in public procurement. Pathway-oriented approaches could help explain how these objectives are jointly achieved and how competence-related mechanisms contribute to managing potential tradeoffs. Longitudinal and comparative studies could further improve understanding of how competence development evolves across contexts and over time.

The complementary NCA reported in [Appendix 3](#) addresses the question of necessity directly and its results are consistent with the theoretical positioning of enabling competences as foundational. Nevertheless, the identified thresholds are sample-specific and based on cross-sectional perceptual data and one innovation-related necessity effect depends on a single influential observation. Future research could validate these minimum levels in larger and longitudinal samples, examine whether necessity thresholds shift across institutional contexts and combine NCA with objective performance indicators to test whether the identified competence thresholds translate into observable performance differences.

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References

- Bals, L., Schulze, H., Kelly, S. and Stek, K. (2019), "Purchasing and supply management (PSM) competencies: current and future requirements", *Journal of Purchasing and Supply Management*, Vol. 25 No. 5, p. 100572, doi: [10.1016/j.pursup.2019.100572](https://doi.org/10.1016/j.pursup.2019.100572).
- Barnes, J. and Liao, Y. (2012), "The effect of individual, network, and collaborative competencies on the supply chain management system", *Sixteenth International working seminar on production economics, Innsbruck, 2010*, Vol. 140 No. 2, pp. 888-899, doi: [10.1016/j.ijpe.2012.07.010](https://doi.org/10.1016/j.ijpe.2012.07.010).
- Berg, A., Alhola, K., Peltomaa, J. and Tietari, S. (2022), "Developing together: the Finnish way of promoting sustainable public procurement", *Journal of Public Procurement*, Vol. 22 No. 4, doi: [10.1108/JOPP-11-2021-0072](https://doi.org/10.1108/JOPP-11-2021-0072).
- Beske-Janssen, P., Johnsen, T., Constant, F. and Wieland, A. (2023), "New competences enhancing procurement's contribution to innovation and sustainability", *Journal of Purchasing and Supply Management*, Vol. 29 No. 3, p. 100847, doi: [10.1016/j.pursup.2023.100847](https://doi.org/10.1016/j.pursup.2023.100847).
- Cabral, S. (2017), "Reconciling conflicting policy objectives in public contracting: the enabling role of capabilities", *Journal of Management Studies*, Vol. 54 No. 6, pp. 823-853, doi: [10.1111/joms.12269](https://doi.org/10.1111/joms.12269).
- Cabral, S., Mahoney, J.T., McGahan, A.M. and Potoski, M. (2019), "Value creation and value appropriation in public and nonprofit organizations", *Strategic Management Journal*, Vol. 40 No. 4, pp. 465-475, doi: [10.1002/smj.3008](https://doi.org/10.1002/smj.3008).
- Caldwell, N.D., Roehrich, J.K. and Davies, A.C. (2009), "Procuring complex performance in construction: London Heathrow terminal 5 and a private finance initiative hospital", *Journal of Purchasing and Supply Management, Special Topic Forum: EurOMA Conference 2008*, Vol. 15 No. 3, pp. 178-186, doi: [10.1016/j.pursup.2009.05.006](https://doi.org/10.1016/j.pursup.2009.05.006).
- Changalima, I.A., Rejeb, A. and Kimario, H.F. (2026), "PLS-SEM in public procurement research: a systematic review of theoretical foundations, constructs and empirical insights", *Journal of Public Procurement*, pp. 1-49, doi: [10.1108/JOPP-06-2025-0056](https://doi.org/10.1108/JOPP-06-2025-0056).
- Cheng, W., Appolloni, A., D'Amato, A. and Zhu, Q. (2018), "Green public procurement, missing concepts and future trends – a critical review", *Journal of Cleaner Production*, Vol. 176, pp. 770-784, doi: [10.1016/j.jclepro.2017.12.027](https://doi.org/10.1016/j.jclepro.2017.12.027).
- Dawes, J. (2008), "Do data characteristics change according to the number of scale points used? An experiment using 5-Point, 7-Point and 10-Point scales", *International Journal of Market Research*, Vol. 50 No. 1, pp. 61-104, doi: [10.1177/147078530805000106](https://doi.org/10.1177/147078530805000106).
- Delamare-Le Deist, F.D. and Winterton, J. (2005), "What is competence?", *Human Resource Development International*, Vol. 8 No. 1, pp. 27-46, doi: [10.1080/1367886042000338227](https://doi.org/10.1080/1367886042000338227).
- Derwik, P. and Hellström, D. (2017), "Competence in supply chain management: a systematic review", *Supply Chain Management: An International Journal*, Vol. 22 No. 2, pp. 200-218, doi: [10.1108/SCM-09-2016-0324](https://doi.org/10.1108/SCM-09-2016-0324).
- Dimitri, N. (2020), "Budget allocation design in the EU pre-commercial procurement for innovation", *Journal of Public Procurement*, Vol. 20 No. 1, p. Article 1, doi: [10.1108/JOPP-07-2019-0036](https://doi.org/10.1108/JOPP-07-2019-0036).
- Dul, J. (2016), "Necessary condition analysis (NCA): logic and methodology of "necessary but not sufficient" causality", *Organizational Research Methods*, Vol. 19 No. 1, pp. 10-52, doi: [10.1177/1094428115584005](https://doi.org/10.1177/1094428115584005).
- Dul, J., van der Laan, E. and Kuik, R. (2020), "A statistical significance test for necessary condition analysis", *Organizational Research Methods*, Vol. 23 No. 2, pp. 385-395, doi: [10.1177/1094428118795272](https://doi.org/10.1177/1094428118795272).
- Edler, J. and Yeow, J. (2016), "Connecting demand and supply: the role of intermediation in public procurement of innovation", *Research Policy*, Vol. 45 No. 2, pp. 414-426, doi: [10.1016/j.respol.2015.10.010](https://doi.org/10.1016/j.respol.2015.10.010).

European Commission (2020a), *ProcurCompEU: Implementation in Estonia*, Publications Office, doi: [10.2873/076447](https://doi.org/10.2873/076447).

European Commission (2020b), *ProcurCompEU: Implementation in Malta*, Publications Office, doi: [10.2873/606579](https://doi.org/10.2873/606579).

Gámez-Pérez, K.M., Sarmiento, A.M., Garcia-Reyes, H. and Velázquez-Martínez, J.C. (2020), “An international university-industry collaboration model to develop supply chain competences”, *Supply Chain Management: An International Journal*, Vol. 25 No. 4, pp. 475-487, doi: [10.1108/SCM-08-2019-0317](https://doi.org/10.1108/SCM-08-2019-0317).

Grandia, J. and Meehan, J. (2017), “Public procurement as a policy tool: Using procurement to reach desired outcomes in society”, *International Journal of Public Sector Management*, Vol. 30 No. 4, pp. 302-309, doi: [10.1108/IJPSM-03-2017-0066](https://doi.org/10.1108/IJPSM-03-2017-0066).

Grimbert, S.F., Zabala-Iturriagaogitia, J.M. and Valovirta, V. (2024), “Transformative public procurement for innovation: ordinary, dynamic and functional capabilities”, *Public Management Review*, pp. 1-24, doi: [10.1080/14719037.2024.2326079](https://doi.org/10.1080/14719037.2024.2326079).

Hair, J.F., Ringle, C.M. and Sarstedt, M. (2011), “PLS-SEM: Indeed a silver bullet”, *Journal of Marketing Theory and Practice*, Vol. 19 No. 2, pp. 139-152, doi: [10.2753/MTP1069-6679190202](https://doi.org/10.2753/MTP1069-6679190202).

Hakansson, H. and Axelsson, B. (2020), “What is so special with outsourcing in the public sector?”, *Journal of Business and Industrial Marketing*, Vol. 35 No. 12, pp. 2011-2021, doi: [10.1108/JBIM-06-2019-0280](https://doi.org/10.1108/JBIM-06-2019-0280).

Harland, C., Eßig, M., Lynch, J. and Patrucco, A. (2021), “Policy-led public procurement: does strategic procurement deliver?”, *Journal of Public Procurement*, Vol. 21 No. 3, pp. 221-228, doi: [10.1108/JOPP-09-2021-089](https://doi.org/10.1108/JOPP-09-2021-089).

Hartley, J. (2014), “Some thoughts on Likert-type scales”, *International Journal of Clinical and Health Psychology*, Vol. 14 No. 1, pp. 83-86, doi: [10.1016/S1697-2600\(14\)70040-7](https://doi.org/10.1016/S1697-2600(14)70040-7).

Hesping, F.H. and Schiele, H. (2015), “Purchasing strategy development: a multi-level review”, *Journal of Purchasing and Supply Management*, Vol. 21 No. 2, pp. 138-150, doi: [10.1016/j.pursup.2014.12.005](https://doi.org/10.1016/j.pursup.2014.12.005).

Holma, A.-M., Østensen, M.W., Holmen, E. and de Boer, L. (2022), “Market dialogue in public procurement: buyer-supplier interfaces and relational abilities”, *Industrial Marketing Management*, Vol. 104, pp. 51-67, doi: [10.1016/j.indmarman.2022.04.004](https://doi.org/10.1016/j.indmarman.2022.04.004).

Johnsen, T., Le Dain, M.-A., Kiratli, N. and Schiele, H. (2022), “Editorial: purchasing and innovation: past, present and future of the field of research”, *Journal of Purchasing and Supply Management*, Vol. 28 No. 2, p. 100768, doi: [10.1016/j.pursup.2022.100768](https://doi.org/10.1016/j.pursup.2022.100768).

Kähkönen, A.-K., Jääskeläinen, A., Karttunen, E., Pedroso, C.B. and Lintukangas, K. (2025), “Promoting supply market development by the dynamic capabilities of innovative public procurement”, *Journal of Purchasing and Supply Management*, Vol. 31 No. 4, p. 101056, doi: [10.1016/j.pursup.2025.101056](https://doi.org/10.1016/j.pursup.2025.101056).

Karttunen, E., Jääskeläinen, A., Malacina, I., Lintukangas, K., Kähkönen, A.-K. and Vos, F.G.S. (2024), “Dynamic capabilities view on value creation in public procurement”, *Journal of Public Procurement*, Vol. 24 No. 1, doi: [10.1108/JOPP-05-2023-0035](https://doi.org/10.1108/JOPP-05-2023-0035).

Karttunen, E., Pesu, J. and Immonen, M. (2025), “Cross-disciplinary perspectives on problem-based learning approach in public procurement in the European Union”, *Journal of Purchasing and Supply Management*, Vol. 31 No. 2, p. Article 2, doi: [10.1016/j.pursup.2025.100992](https://doi.org/10.1016/j.pursup.2025.100992).

Kaufmann, L. and Reimann, F. (2024), “From teaching with cases to teaching through case development: making purchasing managers and students the designers of learning journeys”, *Journal of Purchasing and Supply Management*, Vol. 31 No. 2, p. 100970, doi: [10.1016/j.pursup.2024.100970](https://doi.org/10.1016/j.pursup.2024.100970).

- Kelly, S., Bals, L., Stek, K., Schulze, H. and Israilidis, J. (2025), "Knowledge transformation in purchasing and supply management: a process perspective", *Knowledge and Process Management*, Vol. 32 No. 3, pp. 133-145, doi: [10.1002/kpm.1803](https://doi.org/10.1002/kpm.1803).
- Kock, N. (2015), "Common method bias in PLS-SEM: a full collinearity assessment approach", *International Journal of E-Collaboration (IJeC)*, Vol. 11 No. 4, pp. 1-10, doi: [10.4018/ijec.2015100101](https://doi.org/10.4018/ijec.2015100101).
- Laari-Salmela, S., Mainela, T., Torvinen, H. and Ulkuniemi, P. (2025), "Embedding public procurement for innovation partnerships in place: discursive practices for the place-embedded and responsive relationships", *Journal of Purchasing and Supply Management. Scopus*, doi: [10.1016/j.pursup.2025.101085](https://doi.org/10.1016/j.pursup.2025.101085).
- Lenderink, B., Halman, J.I.M., Boes, J., Voordijk, H. and Dorée, A.G. (2022), "Procurement and innovation risk management: how a public client managed to realize a radical green innovation in a civil engineering project", *Journal of Purchasing and Supply Management*, Vol. 28 No. 1, p. Article 1, doi: [10.1016/j.pursup.2022.100747](https://doi.org/10.1016/j.pursup.2022.100747).
- Lindfors, K., Jääskeläinen, A. and Malacina, I. (2025), "Creating value in infrastructure procurement: a practice-based view", *Journal of Public Procurement*, Vol. 25 No. 3, pp. 321-354, doi: [10.1108/JOPP-06-2024-0072](https://doi.org/10.1108/JOPP-06-2024-0072).
- Lindkvist, H., Lind, F. and Melander, L. (2023), "Actor roles and public-private interaction in transitioning networks: the case of geofencing for urban freight transport in Sweden", *Journal of Business and Industrial Marketing*, Vol. 38 No. 6, pp. 1376-1389, doi: [10.1108/JBIM-10-2021-0494](https://doi.org/10.1108/JBIM-10-2021-0494).
- Loasby, B.J. (1998), "The organization of capabilities", *Journal of Economic Behavior and Organization*, Vol. 35 No. 2, pp. 139-160, doi: [10.1016/S0167-2681\(98\)00056-0](https://doi.org/10.1016/S0167-2681(98)00056-0).
- Loijas, K., Jääskeläinen, A. and Karttunen, E. (2024), "Dyadic capabilities in implementing performance-based public procurement", *Journal of Business and Industrial Marketing*, Vol. 39 No. 13, pp. 128-144, doi: [10.1108/JBIM-09-2023-0542](https://doi.org/10.1108/JBIM-09-2023-0542).
- Lonsdale, C. and Le Mesurier, N. (2024), "Learning to do good: developing capabilities to deliver social value from public procurement within English public authorities", *International Journal of Public Sector Management*, Vol. 37 No. 6, p. Article 6, doi: [10.1108/IJPSM-05-2023-0145/FULL/PDF](https://doi.org/10.1108/IJPSM-05-2023-0145/FULL/PDF).
- Lonsdale, C., Hoque, K., Kirkpatrick, I. and Sanderson, J. (2017), "Knowing the price of everything? Exploring the impact of increased procurement professional involvement on management consultancy purchasing", *Industrial Marketing Management*, Vol. 65, pp. 157-167, doi: [10.1016/j.indmarman.2017.04.001](https://doi.org/10.1016/j.indmarman.2017.04.001).
- Loosemore, M., Keast, R. and Barraket, J. (2022), "A typology of social procurement champions in the construction and engineering industry", *Construction Management and Economics*, Vol. 40 No. 5, pp. 391-405, doi: [10.1080/01446193.2022.2043554](https://doi.org/10.1080/01446193.2022.2043554).
- Malacina, I., EL Bizri, J., Vos, F.G.S., Karttunen, E. and Jääskeläinen, A. (2025), "Leveraging social capital for value creation in public procurement: the role of strategic purchasing integration", *International Journal of Operations and Production Management*, Vol. 45 No. 13, pp. 140-165, doi: [10.1108/IJOPM-06-2024-0524](https://doi.org/10.1108/IJOPM-06-2024-0524).
- Malacina, I., Karttunen, E., Jääskeläinen, A., Lintukangas, K., Heikkilä, J. and Kähkönen, A.-K. (2022), "Capturing the value creation in public procurement: a practice-based view", *Journal of Purchasing and Supply Management*, Vol. 28 No. 2, doi: [10.1016/j.pursup.2021.100745](https://doi.org/10.1016/j.pursup.2021.100745).
- Momeni, K., Raddats, C. and Martinsuo, M. (2023), "Mechanisms for developing operational capabilities in digital servitization", *International Journal of Operations and Production Management*, Vol. 43 No. 13, p. Article 13, doi: [10.1108/IJOPM-04-2022-0259](https://doi.org/10.1108/IJOPM-04-2022-0259).
- Oksanen, J. and Merisalo, M. (2023), "Innovatiiviset ja kestävät julkiset hankinnat suomessa 2022", *KEINO-osaamiskeskus*.

- Picaud-Bello, K., Johnsen, T., Calvi, R. and Giannakis, M. (2019), "Exploring early purchasing involvement in discontinuous innovation: a dynamic capability perspective", *Journal of Purchasing and Supply Management*, Vol. 25 No. 4, p. 100555, doi: [10.1016/J.PURSUP.2019.100555](https://doi.org/10.1016/J.PURSUP.2019.100555).
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903, doi: [10.1037/0021-9010.88.5.879](https://doi.org/10.1037/0021-9010.88.5.879).
- Richter, N.F., Schubring, S., Hauff, S., Ringle, C.M. and Sarstedt, M. (2020), "When predictors of outcomes are necessary: guidelines for the combined use of PLS-SEM and NCA", *Industrial Management and Data Systems*, Vol. 120 No. 12, pp. 2243-2267, doi: [10.1108/IMDS-11-2019-0638](https://doi.org/10.1108/IMDS-11-2019-0638).
- Ringle, C.M., Wende, S. and Becker, J.-M. (2024), "SmartPLS 4".
- Rokkan, A.I. and Haugland, S.A. (2022), "A transaction cost approach for public procurement", *Journal of Business and Industrial Marketing*, Vol. 37 No. 2, p. Article 2, doi: [10.1108/JBIM-09-2019-0393](https://doi.org/10.1108/JBIM-09-2019-0393).
- Santos, J.B. and Cabral, S. (2022), "Public procurement capabilities as engines for collaboration and enhanced performance in complex projects", *International Journal of Operations and Production Management*, Vol. 42 No. 1, pp. 32-58, doi: [10.1108/IJOPM-02-2021-0098](https://doi.org/10.1108/IJOPM-02-2021-0098).
- Sarstedt, M., Hair, J.F., Jr. and Ringle, C.M. (2023), "PLS-SEM: indeed a silver bullet" – retrospective observations and recent advances", *Journal of Marketing Theory and Practice*, Vol. 31 No. 3, pp. 261-275, doi: [10.1080/10696679.2022.2056488](https://doi.org/10.1080/10696679.2022.2056488).
- Schulze, H., Bals, L. and Johnsen, T.E. (2019), "Individual competences for sustainable purchasing and supply management (SPSM)", *International Journal of Physical Distribution and Logistics Management*, Vol. 49 No. 3, pp. 287-304, doi: [10.1108/IJPDLM-01-2018-0036](https://doi.org/10.1108/IJPDLM-01-2018-0036).
- Selviaridis, K. (2021), "Effects of public procurement of RandD on the innovation process: evidence from the UK small business research initiative", *Journal of Public Procurement*, Vol. 21 No. 3, p. Article 3, doi: [10.1108/JOPP-12-2019-0082](https://doi.org/10.1108/JOPP-12-2019-0082).
- Selviaridis, K., Hughes, A. and Spring, M. (2023), "Facilitating public procurement of innovation in the UK defense and health sectors: innovation intermediaries as institutional entrepreneurs", *Research Policy*, Vol. 52 No. 2, p. 104673, doi: [10.1016/j.respol.2022.104673](https://doi.org/10.1016/j.respol.2022.104673).
- Sijtsma, K. (2009), "On the use, the misuse, and the very limited usefulness of Cronbach's alpha", *Psychometrika*, Vol. 74 No. 1, pp. 107-120, doi: [10.1007/s11336-008-9101-0](https://doi.org/10.1007/s11336-008-9101-0).
- Spring, M. and Araujo, L. (2014), "Indirect capabilities and complex performance: implications for procurement and operations strategy", *International Journal of Operations and Production Management*, Vol. 34 No. 2, p. Article 2, doi: [10.1108/IJOPM-01-2011-0034](https://doi.org/10.1108/IJOPM-01-2011-0034).
- Stek, K. and Schiele, H. (2021), "How to train supply managers – necessary and sufficient purchasing skills leading to success", *Journal of Purchasing and Supply Management*, Vol. 27 No. 4, p. 100700, doi: [10.1016/j.pursup.2021.100700](https://doi.org/10.1016/j.pursup.2021.100700).
- Stek, K., Picaud-Bello, K., Koch, V. and Johnsen, T. (2025), "Rethinking purchasing and supply management education for sustainability and innovation challenges: crafting a future-ready competency-based curriculum design", *Journal of Purchasing and Supply Management*, Vol. 31 No. 2, p. 100974, doi: [10.1016/j.pursup.2024.100974](https://doi.org/10.1016/j.pursup.2024.100974).
- Taheriruh, M. (2026), "Managing interaction in innovative public procurement: developing competences for coping with relational frictions [Tampere university]", available at: <https://trepo.tuni.fi/handle/10024/233372>
- Taheriruh, M. and Moshtari, M. (2024), "Symbolic compliance with policy-led public procurement: decoupling practices and compliance barriers", *International Journal of Procurement Management*, Vol. 19 No. 1, pp. 1-20, doi: [10.1504/IJPM.2024.135180](https://doi.org/10.1504/IJPM.2024.135180).

- Taheriruh, M., Jääskeläinen, A., Loijas, K. and Harrison, D. (2025), "Developing and deploying competences for innovative public procurement: a network perspective", *Journal of Purchasing and Supply Management*, Vol. 31 No. 4, p. 101039, doi: [10.1016/j.pursup.2025.101039](https://doi.org/10.1016/j.pursup.2025.101039).
- Taponen, S. and Kauppi, K. (2017), "Forget "blind leading the seeing" – improving public service management", *International Journal of Public Administration*, Vol. 40 No. 13, pp. 1114-1128, doi: [10.1080/01900692.2016.1242617](https://doi.org/10.1080/01900692.2016.1242617).
- Tassabehji, R. and Moorhouse, A. (2008), "The changing role of procurement: developing professional effectiveness", *Journal of Purchasing and Supply Management*, Vol. 14 No. 1, pp. 55-68, doi: [10.1016/j.pursup.2008.01.005](https://doi.org/10.1016/j.pursup.2008.01.005).
- Uenk, N. and Taponen, S. (2020), "Risk allocation in service triads – the case of Dutch and Finnish home care procurement", *Journal of Purchasing and Supply Management*, Vol. 26 No. 4, doi: [10.1016/j.pursup.2020.100647](https://doi.org/10.1016/j.pursup.2020.100647).
- Uyarra, E., Edler, J., Garcia-Estevez, J., Georghiou, L. and Yeow, J. (2014), "Barriers to innovation through public procurement: a supplier perspective", *Technovation*, Vol. 34 No. 10, p. Article 10, doi: [10.1016/j.technovation.2014.04.003](https://doi.org/10.1016/j.technovation.2014.04.003).
- Uyarra, E., Zabala-Iturriagagoitia, J.M., Flanagan, K. and Magro, E. (2020), "Public procurement, innovation and industrial policy: rationales, roles, capabilities and implementation", *Research Policy*, Vol. 49 No. 1, p. Article 1, doi: [10.1016/j.respol.2019.103844](https://doi.org/10.1016/j.respol.2019.103844).
- van Weele, A.J. and van Raaij, E.M. (2014), "The future of purchasing and supply management research: about relevance and rigor", *Journal of Supply Chain Management*, Vol. 50 No. 1, pp. 56-72, doi: [10.1111/jscm.12042](https://doi.org/10.1111/jscm.12042).
- Vis, B. and Dul, J. (2018), "Analyzing relationships of necessity not just in kind but also in degree: complementing fsQCA with NCA", *Sociological Methods and Research*, Vol. 47 No. 4, pp. 872-899, doi: [10.1177/0049124115626179](https://doi.org/10.1177/0049124115626179).

Appendix 1. Survey items

Competence measures (No competence; Basic competence; Advanced competence; Outstanding competence; I could train others in this competence.)

- Procedural competences
 - PC1: Ability to apply multicriteria analysis when evaluating procurement decisions or projects.
 - PC2: Ability to forecast and predict future needs based on forecasts and prior experience.
 - PC3: Legal competence related to CSR and CSDD, including compliance with ethical standards and the spirit of the law.
 - PC4: Understanding of relevant standards applicable to the procurement context.
 - PC5: Ability to apply specific rules, guidelines or standards approved by recognized bodies.
- Relational competences
 - RC1: Ability to share data efficiently with partners through digital or network platforms.
 - RC2: Ability to clearly communicate objectives and expectations to suppliers.
 - RC3: Ability to engage stakeholders through effective communication, active listening and consideration of diverse viewpoints.
 - RC4: Ability to discuss and adapt development activities with partners during the contract period.
 - RC5: Ability to establish and manage innovation partnerships.

- *Enabling competences*

- EC1: Ability to guide and adapt to changes that involve working with others (e.g. customers or partners) to jointly create value.
- EC2: Willingness and ability to take risks when engaging in activities with uncertain outcomes.
- EC3: Ability to manage the overall “big picture” in value co-creation involving multiple actors.

Performance measures (Ranging from strongly disagree (1) to strongly agree (5))

- *Operational performance contribution*

- OP1: My actions contribute positively to higher-than-average cost reductions.
- OP2: Compared with other departments, my department achieves higher-than-average cost reductions.

- *Sustainability performance contribution*

- SP1: My actions contribute to achieving a higher level of sustainability than the organizational average.
- SP2: Compared with other departments, my department demonstrates higher sustainability performance.
- SP3: Long-term sustainable solutions are the result of our procurement activities.

- *Innovation performance contribution*

- IP1: My actions contribute positively to the procurement of innovative products or services.
- IP2: The solutions procured in my organization are more innovative than expected.
- IP3: My actions contribute positively to innovating procurement processes.
- IP4: Procurement processes in my organization are improved through innovative approaches.

Competence development measures (Ranging from strongly disagree (1) to strongly agree (5))

- *Indirect competence development*

- ICD1: We build new competencies with suppliers through interactions in market dialogues.
- ICD2: We develop new competencies by co-creating solutions with suppliers in projects.

- *Direct competence development*

- DCD1: We establish internal teams dedicated to collaborative innovation.
- DCD2: We encourage cross-functional collaboration to co-create sustainable and innovative solutions.
- DCD3: We enhance competencies in complex procurement projects by learning from past experiences.
- DCD4: We learn from practical experiences to improve competencies in complex procurement projects.

Table A1. Descriptive statistics and bivariate spearman correlations among the study constructs

#	Construct	Mean	SD	1	2	3	4	5	6	7
1	Procedural competences	2.681	0.738	–						
2	Relational competences	3.04	0.713	0.437***	–					
3	Enabling competences	3.042	0.721	0.477***	0.606***	–				
4	Operational performance	3.56	0.467	0.351***	0.466***	0.393***	–			
5	Innovation performance	3.01	0.558	0.061	0.217**	0.159*	0.111	–		
6	Sustainability performance	3.483	0.579	0.244**	0.230**	0.250***	0.276***	0.200**	–	
7	Direct competence development	3.767	0.774	0.391***	0.199**	0.201**	0.302***	–0.012	0.254***	–
8	Indirect competence development	3.489	0.83	0.303***	0.192*	0.201**	0.234***	0.150*	0.331***	0.525***

Appendix 3. Necessary condition analysis (NCA)

This appendix reports the complete results of the Necessary Condition Analysis. [Table A2](#) presents the necessity effect sizes and permutation tests, [Figure A1](#) the ceiling plots for the significant necessity relationships and [Tables A3 to A6](#) the bottleneck tables for sustainability performance, innovation performance, procedural competences and relational competences.

Table A2. NCA Effect sizes and permutation test results

Outcome	Condition	d (CE-FDH)	p	d (CR-FDH)	p	Accuracy (%)
Operational performance	Procedural competences	0.000	1.000	0.000	1.000	–
Operational performance	Relational competences	0.131	0.082	0.105	0.084	98.3
Operational performance	Enabling competences	0.000	1.000	0.000	1.000	–
Sustainability performance	Procedural competences	<i>0.180</i>	0.007	0.151	0.013	97.7
Sustainability performance	Relational competences	<i>0.239</i>	0.001	0.213	0.002	94.2
Sustainability performance	Enabling competences	<i>0.151</i>	0.020	0.145	0.009	96.5
Innovation performance	Procedural competences	0.165	0.252	0.153	0.136	98.8
Innovation performance	Relational competences	<i>0.298</i>	< 0.001	0.250	0.003	95.4
Innovation performance	Enabling competences	<i>0.238</i>	0.005	0.193	0.012	96.5
Procedural competences	Enabling competences	<i>0.189</i>	< 0.001	0.150	0.012	97.1
Procedural competences	Direct competence development	0.226	0.134	0.182	0.208	98.3
Procedural competences	Indirect competence development	0.056	0.621	0.037	0.618	99.4
Relational competences	Enabling competences	<i>0.232</i>	< 0.001	0.229	< 0.001	93.6
Relational competences	Direct competence development	0.126	0.564	0.144	0.278	98.8
Relational competences	Indirect competence development	0.070	0.256	0.056	0.246	98.8
Enabling competences	Direct competence development	0.147	0.576	0.146	0.365	98.8
Enabling competences	Indirect competence development	0.073	0.412	0.037	0.519	100.0

Note(s): d = necessity effect size; p = approximate permutation test with 10,000 permutations ([Dul et al., 2020](#)); Accuracy = ceiling accuracy of the CR-FDH line (CE-FDH accuracy is 100% by construction). Effect sizes in bold satisfy the joint criterion for a meaningful necessary condition ($d \geq 0.1$ and $p < 0.05$)

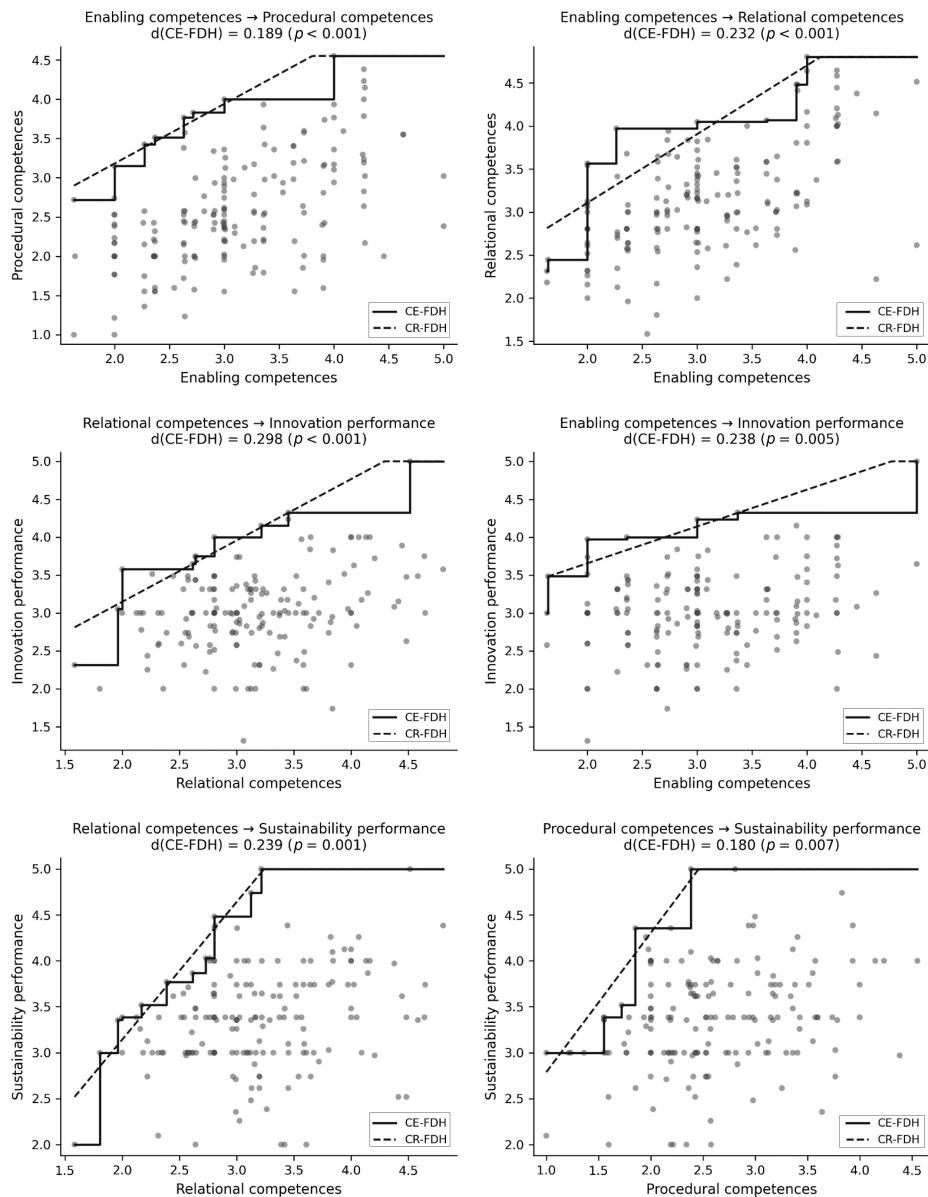


Figure A1. Necessary condition analysis (NCA) results
Source: Authors' own work

Table A3. Bottleneck table for sustainability performance (CE-FDH)

Outcome level (%)	Outcome score	Procedural competences (%)	Relational competences (%)	Enabling competences (%)
0	2.00	NN	NN	NN
10	2.30	NN	1.80 (7)	NN
20	2.60	NN	1.80 (7)	NN
30	2.90	NN	1.80 (7)	NN
40	3.20	1.55 (16)	1.96 (12)	1.64 (0)
50	3.50	1.72 (20)	2.17 (18)	1.64 (0)
60	3.80	1.85 (24)	2.62 (32)	2.00 (11)
70	4.10	1.85 (24)	2.80 (38)	2.72 (32)
80	4.40	2.38 (39)	2.80 (38)	2.72 (32)
90	4.70	2.38 (39)	3.13 (48)	2.72 (32)
100	5.00	2.38 (39)	3.21 (51)	3.90 (68)

Note(s): Required minimum condition levels on the 1–5 metric (percentage of the condition's observed range in parentheses). NN = not necessary at this outcome level

Table A4. Bottleneck table for innovation performance (CE-FDH)

Outcome level (%)	Outcome score	Procedural competences (n.s.)	Relational competences	Enabling competences
0	1.31	NN	NN	NN
10	1.68	NN	NN	NN
20	2.05	NN	NN	NN
30	2.42	NN	1.96 (12%)	NN
40	2.79	NN	1.96 (12%)	NN
50	3.16	1.55 (16%)	2.00 (13%)	1.64 (0%)
60	3.52	2.00 (28%)	2.00 (13%)	2.00 (11%)
70	3.89	2.00 (28%)	2.80 (38%)	2.00 (11%)
80	4.26	2.38 (39%)	3.45 (58%)	3.37 (52%)
90	4.63	2.38 (39%)	4.51 (91%)	5.00 (100%)
100	5.00	2.38 (39%)	4.51 (91%)	5.00 (100%)

Note(s): Required minimum condition levels on the 1–5 metric (percentage of the condition's observed range in parentheses). NN = not necessary at this outcome level

Table A5. Bottleneck table for procedural competences (CE-FDH)

Outcome level (%)	Outcome score	Enabling competences	Direct competence development (n.s.)	Indirect competence development (n.s.)
0	1.00	NN	NN	NN
10	1.35	NN	NN	NN
20	1.71	NN	NN	NN
30	2.07	NN	NN	NN
40	2.42	NN	NN	NN
50	2.78	2.00 (11%)	1.88 (22%)	NN
60	3.13	2.00 (11%)	1.88 (22%)	NN
70	3.49	2.37 (22%)	2.20 (30%)	NN
80	3.84	3.00 (41%)	3.40 (60%)	1.50 (12%)
90	4.20	4.00 (70%)	3.40 (60%)	2.49 (37%)
100	4.55	4.00 (70%)	3.40 (60%)	2.49 (37%)

Note(s): Required minimum condition levels on the 1–5 metric (percentage of the condition’s observed range in parentheses). NN = not necessary at this outcome level

Table A6. Bottleneck table for relational competences (CE-FDH)

Outcome level (%)	Outcome score	Enabling competences	Direct competence development (n.s.)	Indirect competence development (n.s.)
0	1.58	NN	NN	NN
10	1.91	NN	NN	NN
20	2.23	NN	NN	NN
30	2.55	2.00 (11%)	NN	NN
40	2.87	2.00 (11%)	NN	NN
50	3.19	2.00 (11%)	1.30 (7%)	NN
60	3.52	2.00 (11%)	1.30 (7%)	NN
70	3.84	2.26 (19%)	1.30 (7%)	1.50 (12%)
80	4.16	3.90 (68%)	1.30 (7%)	1.50 (12%)
90	4.48	3.90 (68%)	3.12 (53%)	1.50 (12%)
100	4.80	4.00 (70%)	4.18 (79%)	3.00 (50%)

Note(s): Required minimum condition levels on the 1–5 metric (percentage of the condition’s observed range in parentheses). NN = not necessary at this outcome level

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