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# SHAPING PROJECT MANAGEMENT COMPETENCE: AN EXPLORATORY MULTILEVEL STUDY

CATHERINE CABOT

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# SHAPING PROJECT MANAGEMENT COMPETENCE: AN EXPLORATORY MULTILEVEL STUDY

Présentée par : Catherine Cabot

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A été dûment accepté par le jury d'examen constitué de :

M. Martin X. Noël, Ph.D., président

Mme. Véronique Nabelsi, Ph.D., membre et directrice de recherche

M. Christophe Bredillet, Ph.D., membre et codirecteur de recherche

M. Pierre-Paul Morin, ing., Ph.D., membre interne

M. Phillipe Boigey, D.Sc., membre externe

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**ABSTRACT**

With the proliferation of project-based organizations, the development of project activities and their management needs has led to the formalization of practices, the need for a collaborative community of practitioners and the recognition of developing specific project management skills. Alongside the development of the discipline, the expectation of the competent project manager has also evolved over the years to include a wide range of technical and non-technical skills that reflect the complex environment of today's projects. While the project management discipline and project manager competence have continued to evolve, organizations today still struggle to deliver successful project outcomes. Among the critical project success factors cited in the literature, competence consistently stands out as having a significant impact on project outcomes.

A bibliometric analysis reveals two overarching themes related to project management competence: types of competence and how competence is shaped. The literature review organized around these two emerging themes reveals the lack of a comprehensive framework for understanding project management competence. The extensive list of competences that a project manager is expected to learn continues to increase and establishes an unrealistic expectation of the project manager who is often perceived as shouldering the entire responsibility for a project's success or failure. Moreover, the literature predominantly focuses on developing the competence of the individual project manager, ignoring the broader community of practitioners and the levels of competence beyond the individual.

To address this gap, the present study investigates the relationships between individual, collective and organizational competence. In other words, the main research question asks: how is project management competence shaped from a multilevel perspective? Based on a pragmatic research philosophy, this study carries out a quantitative data analysis from 101 participants through an online survey. Participants were asked to reflect on a project that they worked on in the last two years and to keep this project in mind while answering the survey. At the individual level, competence is assessed by teamwork, personal communication and relationships and engagements. At the collective level, similar aspects are assessed for project teams including proactivity, communication, cooperation and Interpersonal Relationship. At the organizational level, competence is evaluated based on the organizations' ability to manage competence

requirements, assess the current state of their workforce's competence, attract people with the right competence and enable competence development.

The study's findings indicate a strong positive and reciprocal relationship between individual, organizational, and collective competence. The research offers valuable theoretical and practical insights. From a theoretical perspective, this research advances the understanding of competence within project-based environments by framing it as a multilevel construct. It addresses a significant gap in the literature by adopting a multilevel lens and introduces a comprehensive framework that challenges the traditional view that the project manager alone is responsible for the outcome of the project.

Practically, this research encourages organizations to adopt a broader perspective on project success, one that acknowledges the critical role of teams and organizational systems alongside individual capabilities. It advocates for competence development across all levels of the organization, which can lead to more consistent and successful project delivery. The findings also provide an opportunity to rethink traditional performance evaluation systems to include assessment of team collaboration and organizational contributions. Moreover, organizations are encouraged to invest in structures and policies that attract competent individuals and teams, foster their development throughout their careers, and empower these individuals and teams to actively contribute to organizational improvement.

This research also acknowledges several limitations including discriminant validity concerns, reliance on self-reported data, and a limited sample scope. These limitations provide opportunities for future research, which could build on this study by expanding participant diversity, exploring additional levels of constructs within the competence framework, incorporating different types of research methods, and including contextual factors as mediating constructs.

**RÉSUMÉ**

Avec la prolifération des organisations orientées projet, le développement des activités de projet et de leurs besoins en gestion a mené à la formalisation des pratiques, à la nécessité d'une communauté collaborative de praticiens et à la reconnaissance du développement de compétences spécifiques en gestion de projet. Parallèlement au développement de la discipline, les attentes à l'égard du chef de projet compétent ont également évolué au fil des années pour inclure un large éventail de compétences techniques et non techniques, reflétant la complexité des environnements actuels de projet.

Bien que la discipline de gestion de projet et les compétences des chefs de projet aient continué à évoluer, les organisations ont de la difficulté encore aujourd'hui à obtenir des résultats probants dans leurs projets. Parmi les facteurs critiques de réussite des projets cités dans la littérature, la compétence ressort systématiquement comme ayant un impact significatif sur les résultats des projets.

Une analyse bibliométrique révèle deux grands thèmes liés aux compétences en gestion de projet : les types de compétences et la manière dont elles se construisent. La revue de la littérature, organisée autour de ces deux thèmes émergents, révèle l'absence d'un cadre global permettant de comprendre les compétences en gestion de projet. La liste, sans cesse croissante, des compétences attendues d'un chef de projet engendre des attentes irréalistes à son égard, celui-ci étant souvent perçu comme seul responsable de la réussite ou de l'échec du projet. De plus, la littérature se concentre principalement sur le développement des compétences du chef de projet individuel, en négligeant la communauté élargie de praticiens ainsi que les niveaux de compétence au-delà de l'individu.

Pour combler cette lacune, la présente étude explore les relations entre les compétences individuelles, collectives et organisationnelles. En d'autres termes, la question centrale de recherche est la suivante : comment les compétences en gestion de projet se construisent-elles à travers une perspective multiniveau? S'appuyant sur une philosophie de recherche pragmatique, cette étude réalise une analyse de données quantitatives recueillies auprès de 101 participants via une enquête en ligne. Il a été demandé aux participants de réfléchir à un projet sur lequel ils avaient

travaillé au cours des deux dernières années et de garder ce projet en mémoire pour répondre à l'enquête.

Au niveau individuel, les compétences sont évaluées à travers le travail en équipe, la communication personnelle, les relations et les engagements. Au niveau collectif, des aspects similaires sont évalués pour les équipes projet, notamment la proactivité, la communication, la coopération et les relations interpersonnelles. Au niveau organisationnel, la compétence est évaluée en fonction de la capacité des organisations à gérer les exigences en matière de compétences, à évaluer l'état actuel des compétences de leur personnel, à attirer des personnes ayant les compétences requises et à favoriser le développement des compétences.

Les résultats de l'étude indiquent une relation forte, positive et réciproque entre les compétences individuelles, organisationnelles et collectives. La recherche apporte des contributions théoriques et pratiques précieuses. D'un point de vue théorique, cette étude fait progresser la compréhension des compétences dans les environnements orientés projets en les conceptualisant comme un construit multiniveau. Elle comble une lacune importante dans la littérature en adoptant cette perspective multiniveau et en introduisant un cadre complet qui remet en question la vision traditionnelle selon laquelle le gestionnaire de projet serait seul responsable du succès du projet.

Sur le plan pratique, cette recherche encourage les organisations à adopter une vision plus large de la réussite des projets, en reconnaissant le rôle essentiel des équipes et des systèmes organisationnels, en plus des capacités individuelles. Elle préconise le développement des compétences à tous les niveaux de l'organisation, ce qui peut mener à une exécution des projets plus cohérente et réussie. Les résultats offrent également l'occasion de repenser les systèmes traditionnels d'évaluation de la performance, en y intégrant l'évaluation de la collaboration au sein des équipes et des contributions organisationnelles. Par ailleurs, il est recommandé aux organisations d'investir dans des structures et des politiques qui attirent des personnes et des équipes compétentes, soutiennent leur développement tout au long de leur carrière, et les habilitent à contribuer activement à l'amélioration organisationnelle.

Enfin, cette recherche reconnaît plusieurs limites, notamment des préoccupations liées à la validité discriminante, la dépendance à l'égard de données auto-déclarées, et la portée restreinte de

l’échantillon. Ces limites ouvrent la voie à des recherches futures, qui pourraient s’appuyer sur cette étude en élargissant la diversité des participants, en explorant d’autres niveaux de construction dans le cadre des compétences, en intégrant différents types de méthodes de recherche, et en tenant compte des facteurs contextuels comme variables médiatrices.

## CONDENSÉ EN FRANÇAIS DE LA THÈSE

### Chapitre 1 : Introduction générale

Cette recherche débute par un survol historique de la gestion de projet, en parallèle avec l'évolution des compétences en gestion de projet. Avec la prolifération des organisations orientées projet, le développement des activités de projet et des besoins en gestion a mené à une formalisation des pratiques, à la création d'une communauté collaborative de praticiens et à la reconnaissance de compétences spécifiques en gestion de projet. Parallèlement au développement de la discipline, les attentes envers le gestionnaire de projet compétent ont également évolué au fil du temps pour inclure un large éventail de compétences techniques et non techniques, reflétant la complexité croissante des projets actuels.

Dans ce contexte d'évolution, deux courants de pensée en gestion de projet, la gestion de projet traditionnelle (*mainstream project management*) et le courant critique (*Making Projects Critical*), présentent des perspectives divergentes quant à la nature du projet, au rôle du gestionnaire de projet et au profil de compétences souhaité. La recherche en gestion de projet traditionnelle met l'accent sur les compétences techniques, qui dominent dans de nombreuses études. Le principal enjeu avec cette approche est qu'elle suppose que le rôle du gestionnaire de projet se limite à l'exécution, sans reconnaître son « rôle potentiel plus large en tant qu'acteur social et politique compétent dans des structures complexes organisées en mode projet » (Cicmil et al., 2006, p. 679). Le courant critique propose une lecture plus réflexive des projets, reconnaissant que les gestionnaires de projet doivent naviguer dans des environnements sociaux et politiques complexes, tout en veillant à ce que le projet soit livré à temps et selon le budget. Un profil de compétences critiques en gestion de projet exige donc des habiletés qui préparent le gestionnaire à faire face à la complexité et à l'incertitude du milieu de projet, s'éloignant ainsi de l'approche traditionnelle qui privilégie les compétences techniques visant le contrôle du projet. En somme, la gestion de projet traditionnelle et le courant critique reposent sur des paradigmes différents, ce qui mène naturellement à des visions distinctes du projet, du rôle du gestionnaire et du profil de compétences recherché.

À partir de cette divergence, il devient évident qu'à mesure que les environnements de projet deviennent de plus en plus complexes, les compétences non techniques comme le leadership

et la communication gagnent en importance. Toutefois, les compétences en gestion de projet n'ont peut-être pas suffisamment évolué pour répondre à cette complexité croissante. Bien que la discipline de gestion de projet et les compétences des gestionnaires aient progressé, les organisations peinent encore aujourd'hui à atteindre des résultats probants. Le développement du bon ensemble de compétences en gestion de projet demeure un défi multidimensionnel, comme en témoignent les résultats de l'analyse bibliométrique, qui révèlent certaines lacunes dans ce domaine de recherche.

L'analyse bibliométrique démontre que la littérature classe généralement les compétences en gestion de projet en deux grandes catégories : 1. les types de compétences; et 2. la façon dont elles se développent. Les recherches associées à la première catégorie mettent en évidence de longues listes de compétences que le ou la gestionnaire de projet est censé(e) maîtriser, listes qui ne cessent de s'allonger et qui mènent à des attentes irréalistes envers cette personne, souvent perçue comme portant seule la responsabilité du succès ou de l'échec du projet (Loufrani-Fedida & Missonier, 2015). Cela contribue à entretenir une image faussée du gestionnaire de projet, perçu comme un « héros » (Loufrani-Fedida & Missonier, 2015) ou un « gestionnaire magicien » (Napier et al., 2009), ce qui nuit à l'organisation en générant des tensions et un manque de collaboration entre les membres de l'équipe (Tourish, 2019). En conséquence, plusieurs études se sont concentrées sur les compétences individuelles du gestionnaire de projet, sans pour autant permettre de répondre efficacement à ces attentes démesurées.

De la même manière, les recherches qui relèvent de la deuxième catégorie examinent le développement des compétences en gestion de projet, tout en mettant en lumière une approche fragmentée et étroite centrée sur les compétences individuelles. La littérature porte principalement sur le développement des compétences du gestionnaire de projet en tant qu'individu. Bien qu'il existe certaines recherches portant sur les compétences collectives et organisationnelles, ces perspectives demeurent rares et peu explorées par rapport à l'approche individuelle.

Des chercheurs appellent à inclure différents niveaux d'analyse dans les études en gestion de projet, allant de l'individuel au sociétal (Geraldi & Soderlund, 2018; Loufrani-Fedida & Missonier, 2015), ce qui ouvre la voie à l'élaboration d'un cadre plus global des compétences en gestion de projet. Bien que les recherches sur ce sujet soient limitées, le concept d'analyse

multiniveaux pourrait offrir une perspective plus riche et nuancée en tenant compte des interconnexions des compétences à différents niveaux, comme le suggèrent Loufrani-Fedida and Missonier (2015) avec le niveau individuel, collectif et organisationnel. De plus, certaines études avancent que les compétences collectives sont essentielles à la réussite des projets (Ruuska & Teigland, 2009; Ruuska & Vartiainen, 2003).

S'éloigner d'une approche centrée sur les compétences individuelles pourrait permettre de mieux représenter les dynamiques complexes qui existent au sein des individus, des équipes et des organisations. Cette compréhension élargie permettrait aussi de mieux saisir comment les compétences se développent à tous les niveaux et de quelle manière elles influencent le succès des projets. Ainsi, cette recherche vise principalement à comprendre comment les compétences en gestion de projet se développent à travers une approche multiniveau. Cela nous amène à la question de recherche principale suivante :

**Comment les compétences en gestion de projet se construisent-elles à travers une perspective multiniveau?**

Cette question implique de comprendre comment les compétences sont reliées entre les niveaux individuel (X), collectif (Y) et organisationnel (Z), et dans quelle mesure ces connexions s'influencent mutuellement. Cette étude s'inscrit dans les domaines de recherche plus larges des organisations temporaires, des compétences et des études de processus, et s'appuie sur les théories et les concepts issus de ces champs pour répondre à la question de recherche centrée sur les compétences.

## Chapitre 2 : Revue de la littérature

Cette étude s'appuie sur une philosophie de recherche pragmatique et adopte les postulats d'une ontologie du « devenir » (*becoming*) ainsi qu'une approche processuelle dans l'acquisition des connaissances. La théorie principale mobilisée dans ce cadre est celle des organisations temporaires. De plus, afin de comprendre les relations entre les différents niveaux de compétence, cette recherche examine trois niveaux d'analyse : la compétence individuelle (X), la compétence collective (Y) et la compétence organisationnelle (Z).

La compétence individuelle a été définie et interprétée de plusieurs façons au fil des années, tant par les chercheurs que par les organismes professionnels de référence. Le monde académique a également proposé une multitude de façons de catégoriser la compétence individuelle. Des associations professionnelles comme le Project Management Institute (PMI) et l'International Project Management Association (IPMA) ont aussi publié leurs propres cadres de compétences, qui sont largement utilisés aujourd'hui. Parmi les divers cadres proposés, celui de l'IPMA se démarque pour cette recherche, car il reconnaît l'influence de la compétence d'équipe et de la compétence organisationnelle sur la compétence individuelle. Ainsi, au niveau individuel, cette étude adopte le cadre de l'IPMA Individual Competence Baseline (ICB) pour évaluer les compétences. Plus précisément, elle met l'accent sur trois dimensions mesurables de la compétence individuelle qui sont définies dans l'IPMA ICB: le travail d'équipe (TW), la communication personnelle (PC), et les relations et engagements (RE).

La compétence collective s'appuie sur plusieurs cadres théoriques, tels que la théorie des systèmes distribués, la théorie de la cognition et la théorie de l'apprentissage situé. Malgré les preuves de l'importance des compétences collectives dans la réussite des projets, on constate une rareté notable de modèles et de cadres conceptuels portant sur les compétences collectives, tant dans la littérature scientifique que dans les référentiels professionnels. Contrairement aux cadres de compétence individuelle largement publiés par des organisations comme le PMI ou l'IPMA, il n'existe pas de cadre reconnu spécifiquement dédié à la compétence collective. Bien que l'IPMA reconnaisse l'importance de la compétence d'équipe dans certaines de ses publications, elle ne propose pas de cadre structuré qui couvre les entités collectives et qui pourrait faire le lien entre les niveaux individuel et organisationnel. Compte tenu de cette rareté dans la littérature et les milieux professionnels, les options disponibles pour sélectionner un cadre adéquat au niveau collectif sont limitées. Idéalement, l'adoption d'un modèle publié par l'IPMA aurait été souhaitable afin de maintenir une cohérence avec le cadre retenu au niveau individuel. Malgré cette contrainte, l'outil développé par Macke and Crespi (2016) s'avère un bon choix, car il s'aligne bien avec les compétences sélectionnées au niveau individuel. En outre, il fournit des dimensions mesurables pour évaluer les compétences collectives incluant la proactivité (PRO), la communication (COMM), la coopération (COOP) et les relations interpersonnelles (IR). En conséquence, l'instrument de Macke and Crespi (2016) est retenu comme outil de mesure pour

cette étude. Ce choix permet d'assurer une cohérence entre les cadres d'évaluation des compétences individuelles et collectives.

La compétence organisationnelle repose la théorie des ressources de l'entreprise (*resource-based view*), qui vise à intégrer à la fois la perspective des ressources et celle des produits dans un contexte organisationnel. Du point de vue de la communauté de pratique en gestion de projet, les définitions de la compétence organisationnelle demeurent toutefois limitées. L'IPMA ICB (IPMA, 2016) offre une vue intégrée des compétences individuelles, collectives et organisationnelles, ce qui permet aux praticiens d'aborder la compétence organisationnelle dans une perspective plus globale et interconnectée. Dans cette recherche, l'IPMA Organisational Competence Baseline (OCB) est adoptée comme cadre de référence principal pour définir la compétence organisationnelle. Elle s'articule de manière complémentaire à l'IPMA ICB, qui est déjà mobilisée dans cette recherche pour structurer la notion de compétence individuelle. Par ailleurs, afin de circonscrire la portée de l'analyse et d'assurer une cohérence entre les niveaux d'évaluation, la recherche se concentre sur les compétences humaines PP&P (People, Practice & Perspective). Dans le contexte de cette recherche, celles-ci comprennent les dimensions suivantes: les exigences en compétences humaines (*People's Competences Requirements*) (PCR), l'état des compétences humaines (*People's Competences State*) (PCS), l'acquisition des compétences humaines (*People's Competences Acquisition*) (PCA) et le développement des compétences humaines (*People's Competences Development*) (PCD). Cette approche favorise une vision intégrée et cohérente des compétences à travers tous les niveaux analysés.

Maintenant que les définitions des compétences individuelle, collective et organisationnelle sont établies, cette recherche examine les études existantes afin de mieux comprendre la nature des relations entre ces différents niveaux. L'objectif est d'extraire des résultats pertinents de ces recherches afin de formuler des hypothèses qui répondent aux questions de recherche de cette étude. Il est également important de souligner que l'approche privilégiée est d'abord d'examiner la corrélation entre une seule paire de variables à la fois, plutôt qu'entre l'ensemble des variables simultanément. Cette approche permet de mieux comprendre les structures et processus sous-jacents qui relient chaque paire de variables. À mesure que le nombre de variables augmente, comme c'est le cas dans cette étude, qui en compte trois, l'analyse de leurs relations combinées devient de plus en plus complexe. Ainsi, cette étude choisit délibérément de

considérer ces relations comme des associations distinctes. Cette démarche vise à dégager des pistes de réflexion claires, qui pourront ensuite servir de fondement à des recherches futures visant à explorer plus en profondeur la complexité des réseaux relationnels entre ces dimensions.

La relation entre la compétence individuelle (X) et la compétence collective (Y)

Selon le cadre théorique proposé par Wiewiora et al. (2019), il y des preuves dans la littérature existante qui suggère l'existence d'un flux d'apprentissage anticipatif (*feed-forward learning flow*) entre les niveaux individuel et collectif au sein d'une organisation, mettant ainsi en évidence l'interdépendance entre ces deux niveaux. Plusieurs facteurs, comme la culture, le leadership, les dynamiques politiques et les modèles mentaux partagés, peuvent faciliter ou freiner ce transfert d'apprentissage des individus vers les équipes. Par conséquent, l'hypothèse abductive suivante est formulée à propos de la relation entre la compétence individuelle et la compétence collective:

*H1-1: La compétence individuelle (X) influence la compétence collective (Y).*

La relation entre la compétence collective (Y) et la compétence individuelle (X)

Le flux d'apprentissage rétroactif (*feedback learning flow*) entre les niveaux collectif et individuel, tel que proposé dans le cadre de Wiewiora et al. (2019) démontre également que la compétence collective peut influencer la compétence individuelle. Plus précisément, les modèles mentaux partagés ne servent pas seulement au transfert de connaissances de l'individu vers l'équipe, mais facilitent également le transfert inverse, de l'équipe vers l'individu. Par exemple, l'utilisation de systèmes d'ordonnancement intégrés et d'autres outils peut favoriser une compréhension commune à la fois au niveau individuel et collectif. En conséquence, l'hypothèse abductive suivante est formulée :

*H1-2: La compétence collective (Y) influence la compétence individuelle (X).*

La relation entre la compétence collective (Y) et la compétence organisationnelle (Z)

L'étude de Melkonian and Picq (2011) offre des perspectives intéressantes sur la relation récursive entre la compétence collective et la compétence organisationnelle. En prenant les Forces spéciales comme étude de cas, cette recherche examine comment les capacités organisationnelles

en gestion de projet se construisent selon une perspective multiniveau, allant de l'équipe à l'organisation (*bottom-up*). Le retour à l'étude de Wiewiora et al. (2019) est également utile pour mieux comprendre cette relation, en mettant en évidence que la structure organisationnelle et les dynamiques politiques influencent le flux d'apprentissage anticipatif entre les niveaux collectif et organisationnel. Sur la base des résultats de ces études, l'hypothèse de travail abductive suivante est formulée pour comprendre l'influence de la compétence collective sur la compétence organisationnelle :

*H2-1: La compétence collective (Y) influence la compétence organisationnelle (Z).*

La relation entre la compétence organisationnelle (Z) et la compétence collective (Y)

En revenant à l'étude de Melkonian and Picq (2011), la dimension descendante (*top-down*) des capacités de projet met en évidence les caractéristiques stables des organisations orientées projet, comme les stratégies et les processus qui encadrent les activités de projet au niveau collectif. Par ailleurs, l'étude de Vera and Crossan (2004) démontre que les styles de leadership transformationnel et transactionnel ont un impact positif sur le flux d'apprentissage de l'organisation vers l'équipe. Les leaders transformationnels favorisent l'apprentissage collectif pendant les périodes de transition grâce à leur capacité à promouvoir une nouvelle vision stratégique. À l'inverse, les leaders transactionnels sont mieux placés pour renforcer les routines organisationnelles existantes et ainsi influencer l'apprentissage au sein des équipes. Sur cette base, l'hypothèse de travail abductive suivante est formulée :

*H2-2: La compétence organisationnelle (Z) influence la compétence collective (Y)*

La relation entre la compétence individuelle (X) et la compétence organisationnelle (Z)

Les travaux de Wiewiora et al. (2019) fournissent également des preuves appuyant une relation dynamique entre la compétence individuelle et la compétence organisationnelle. Leurs résultats soulignent que des éléments comme la culture, la structure organisationnelle et les dynamiques politiques facilitent le flux d'apprentissage anticipatif entre les niveaux individuel et organisationnel, les leaders jouant un rôle clé dans la promotion de l'apprentissage dans les deux sens entre ces niveaux. En se fondant sur ces constats, l'hypothèse de travail abductive suivante est proposée :

*H3-1 : La compétence individuelle (X) influence la compétence organisationnelle (Y)*

La relation entre la compétence organisationnelle (Z) et la compétence individuelle (Y)

Toujours dans l'étude de Wiewiora et al. (2019), on apprend que les leaders transformationnels et transactionnels ne se contentent pas de faciliter l'apprentissage de l'organisation vers l'équipe: ils étendent également ce flux d'apprentissage jusqu'au niveau individuel. Par exemple, les leaders qui renforcent les routines organisationnelles contribuent à un apprentissage rétroactif, influençant ainsi la compétence individuelle. En complément, les conclusions de l'étude de Melkonian and Picq (2011) soulignent que les processus de ressources humaines organisationnels influencent également la formation des individus tout au long de leur carrière, contribuant ainsi à façonner leurs compétences au fil du temps. Sur la base de ces résultats, l'hypothèse de travail abductive suivante est formulée :

*H3-2 : La compétence organisationnelle (Y) influence la compétence individuelle (X)*

**Chapitre 3 : Le cadre opérationnel**

Le cadre opérationnel de cette recherche repose sur une approche pragmatique. L'enquête pragmatique encourage la production de connaissances utiles et applicables dans des contextes réels. De plus, cette recherche s'appuie sur des méthodes quantitatives pour recueillir et analyser les données, dans le but de comprendre dans quelle mesure un construit influence un autre. Plus précisément, l'objectif est d'éclairer dans quelle mesure la compétence à un niveau donné influence celle à un autre niveau. Cette approche quantitative facilite également la mesure et l'analyse de ces influences. En outre, compte tenu des contraintes de temps associées à la réalisation de cette recherche, l'approche quantitative s'avère plus appropriée pour le traitement d'un volume important de données. Donc, l'étape abductive de l'approche pragmatique demande de reformuler chaque hypothèse en proposition mesurable pouvant être évaluée par des méthodes quantitatives. Chaque proposition précise une relation statistiquement testable entre les trois principaux construits :

- P1-1: La compétence individuelle (X) exerce une influence statistiquement significative sur la compétence collective (Y).

- P1-2: La compétence collective (Y) exerce une influence statistiquement significative sur la compétence individuelle (X).
- P2-1: La compétence collective (Y) exerce une influence statistiquement significative sur la compétence organisationnelle (Z).
- P2-2: La compétence organisationnelle (Z) exerce une influence statistiquement significative sur la compétence individuelle (X).
- P3-1: La compétence individuelle (X) exerce une influence statistiquement significative sur la compétence organisationnelle (Z).
- P3-2 : La compétence organisationnelle (Z) exerce une influence statistiquement significative sur la compétence individuelle (Y).

Afin de tester ces propositions, cette recherche a recueilli des données à l'aide d'un sondage en ligne. L'avantage principal des sondages est leur forte validité externe, car ils peuvent être distribués à grande échelle afin de maximiser le nombre de répondants, ce qui permet d'obtenir un échantillon suffisamment large pour que les résultats puissent éventuellement être généralisés (Bell & Bryman, 2018). De plus, les sondages présentent un haut degré de reproductibilité, ce qui facilite leur réutilisation par d'autres chercheurs dans le cadre d'études futures.

Le sondage a été conçu à l'aide de LimeSurvey, l'outil principal fourni par l'Université du Québec en Outaouais. Afin de maximiser la portée, le sondage était disponible en français et en anglais. La traduction bilingue a été révisée et validée par les co-directeurs de recherche pour garantir l'équivalence conceptuelle entre les deux langues.

Le sondage débutait avec cinq questions démographiques portant sur le genre, l'âge, le niveau d'éducation, l'expérience en gestion de projet, et l'expérience actuelle dans l'industrie. On a demandé aux participants de réfléchir à un projet réalisé au cours des deux dernières années et de garder ce projet en tête tout au long du sondage. Donc, les participants devaient aussi répondre à trois questions concernant le projet choisi, notamment le type de projet, son niveau de complexité et leur rôle spécifique dans celui-ci.

Ensuite, les participants ont répondu à 54 questions mesurant les compétences individuelles, collectives et organisationnelles en lien avec leur projet, à l'aide d'une échelle de Likert à 7 points. Ces 54 questions ont été adaptées à partir d'outils de mesure existants et validés dans la littérature scientifique.

La collecte de données a eu lieu entre le 24 février et le 18 juin 2025. Le lien vers le sondage a été diffusé par les co-directeurs de l'étude auprès de différentes organisations, communautés et plateformes dédiées au partage des connaissances en gestion de projet, aux meilleures pratiques et aux ressources, notamment PMI, LinkedIn et d'autres communautés de pratique. Des rappels ont été envoyés après la première semaine, la deuxième semaine et vers la fin de la période de collecte afin d'encourager la participation.

Au sein du Ministère de la Défense nationale (MDN), le sondage a été diffusé auprès de la communauté militaire du génie aérospatial via un canal dédié sur MS Teams, ainsi qu'auprès d'autres collègues professionnels via courriel. L'objectif était de rejoindre un échantillon diversifié en termes d'expérience et de secteurs d'activité, afin de permettre des analyses comparatives potentielles dans les résultats ou pour des recherches futures.

Au total, 152 participants ont accédé au sondage en ligne, mais seuls 101 ont complété l'intégralité du sondage. 51 réponses sont restées incomplètes. Cette étude se concentre donc sur l'analyse des 101 réponses complètes (N = 101).

Les données ont été analysées à l'aide de la modélisation par équations structurelles selon la méthode des moindres carrés partiels (PLS-SEM), avec le logiciel SmartPLS 4, afin de tester les propositions et ainsi les hypothèses abductives à l'étude. Pour analyser les relations bidirectionnelles entre les compétences individuelle, collective et organisationnelle avec PLS-SEM, le modèle conceptuel a été divisé en trois sous-modèles afin de rendre possible l'analyse de relations récursives sous forme linéaire :

- **Sous-modèle 1**: traite les propositions **P1-1** (*La compétence individuelle (X) exerce une influence statistiquement significative sur la compétence collective (Y)*) et **P3-1** (*La compétence individuelle (X) exerce une influence statistiquement significative sur la compétence organisationnelle (Z)*).

- **Sous-modèle 2**: traite les propositions **P1-2** (*La compétence collective (Y) exerce une influence statistiquement significative sur la compétence individuelle (X)*) et **P2-1** (*La compétence collective (Y) exerce une influence statistiquement significative sur la compétence organisationnelle (Z)*).

- **Sous-modèle 3**: traite les propositions **P2-2** (*La compétence organisationnelle (Z) exerce une influence statistiquement significative sur la compétence individuelle (X)*) et **P3-2** (*La compétence organisationnelle (Z) exerce une influence statistiquement significative sur la compétence individuelle (Y)*).

En général, la taille minimale de l'échantillon pour les analyses PLS-SEM est estimée à l'aide de la règle du 10 fois (Hair et al., 2011). Pour cette étude, la taille minimale requise est de 90 participants, déterminée à partir du plus grand nombre d'indicateurs dans une dimension (soit neuf indicateurs pour la dimension de proactivité dans la compétence collective).

Cette étude utilise la méthode d'estimation en deux étapes (*two-stage approach*) pour modéliser les construits de second ordre (compétences individuelle, collective et organisationnelle). Cette méthode courante en PLS-SEM exige une attention particulière aux modèles de mesure pour les composantes de premier ordre et de second ordre.

À la première étape, la méthode des indicateurs répétés est utilisée, selon laquelle les construits de second ordre se voient attribuer les mêmes indicateurs que ceux associés à leurs variables de premier ordre correspondantes. Durant cette étape, le modèle de mesure est évalué et ajusté au besoin afin d'éliminer toute relation non significative. Le modèle structurel, quant à lui, n'est pas évalué à cette étape. L'objectif est plutôt de calculer les scores des variables latentes de premier ordre, qui serviront ensuite d'indicateurs pour les construits de second ordre. Comme l'expliquent Sarstedt et al. (2019), « au lieu d'interpréter les estimations du modèle… les chercheurs doivent sauvegarder les scores de tous les construits du modèle et les ajouter en tant que nouvelles variables dans l'ensemble de données » (p. 199). L'évaluation du modèle de mesure à cette étape inclut l'examen de plusieurs indicateurs clés, notamment les charges factorielles de tous les indicateurs, la fidélité composite, la validité convergente (mesurée par l'alpha de Cronbach et la variance moyenne extraite), ainsi que la validité discriminante.

À la deuxième étape, les scores des variables latentes obtenus à l'étape 1 servent d'indicateurs pour construire le modèle de mesure des construits de second ordre (Sarstedt et al., 2019). Le modèle de mesure est ensuite évalué et ajusté au besoin afin d'éliminer toute relation non significative. L'évaluation du modèle de mesure repose sur les mêmes indicateurs clés qu'à l'étape 1, telle que les charges factorielles, la fidélité composite, la validité convergente et la validité discriminante. De plus, d'autres mesures doivent être prises en compte pour évaluer le modèle structurel, notamment : le coefficient de trajectoire (*path coefficient*), le coefficient de détermination ($R^2$), la taille de l'effet ($f^2$) et la valeur p et la valeur t.

**Chapitre 4 : Résultats de l'analyse de données**

Avant d'entamer la modélisation en deux étapes, des statistiques descriptives ont été analysées afin de dresser un portrait général du profil démographique des 101 participants ayant complété le sondage. L'analyse portait sur des variables telles que le genre, l'âge, le niveau d'éducation, l'expérience en gestion de projet, le secteur industriel actuel, le type de projet réalisé, la complexité du projet et le rôle des participants dans celui-ci. Les fréquences et pourcentages ont été calculés afin de résumer ces caractéristiques démographiques. Ces informations permettent non seulement d'obtenir un aperçu précieux du profil des répondants, mais elles servent également de référence utile pour des recherches futures, notamment pour comparer différents sous-groupes au sein de l'échantillon. Enfin, la moyenne, la médiane, l'écart-type, ainsi que les valeurs minimale et maximale des variables observées pour les construits de premier ordre ont également été calculés.

Après avoir analysé les statistiques descriptives, le processus de modélisation en deux étapes a été lancé dans SmartPLS 4. Les résultats de l'analyse des données soutiennent les six propositions testables, et par conséquent, les six hypothèses. De manière générale, les résultats mettent en évidence des relations fortes et statistiquement significatives entre les construits. Les coefficients de trajectoire *(path coefficients*) les plus élevés ont été observés entre la compétence individuelle (X) et la compétence collective (Y), avec une valeur de 0.840 pour $X \rightarrow Y$, et une valeur similaire de 0.842 pour $Y \rightarrow X$. La deuxième relation bidirectionnelle la plus forte concerne la compétence collective (Y) et la compétence organisationnelle (Z), avec des coefficients de 0.596 pour $Y \rightarrow Z$ et 0.599 pour $Z \rightarrow Y$. Les coefficients les plus faibles ont été relevés entre la

compétence organisationnelle (X) et la compétence collective (Z), avec 0.529 pour X → Z et 0.519 pour Z → X. Ces résultats corroborent les recherches antérieures et renforcent les perspectives théoriques et les preuves empiriques présentées dans la littérature quant à l'interconnexion des compétences aux différents niveaux de l'organisation.

Dans le cadre de l'approche en deux étapes du PLS-SEM, le coefficient de détermination ($R^2$) pour chaque construit endogène dans les trois sous-modèles distincts a été évalué dans la section 4.2. Le $R^2$ reflète le pourcentage de variance de la variable dépendante qui est expliqué par la variable indépendante. Selon Hair et al. (2011), une valeur de $R^2$ supérieure à 0.75 est considérée comme élevée, supérieure à 0.5 comme modérée, et supérieure à 0.25 comme faible.

Pour le sous-modèle 1, le $R^2$ pour la compétence collective est de 0.705, ce qui indique que la compétence individuelle explique 70.5 % de la variance de la compétence collective. Le $R^2$ pour la compétence organisationnelle est de 0.280, ce qui signifie que la compétence individuelle explique 28.0 % de la variance de la compétence organisationnelle. Comme les deux valeurs de $R^2$ sont supérieures à 0.5 mais inférieures à 0.75, elles sont considérées comme modérées.

Pour le sous-modèle 2, le $R^2$ pour la compétence individuelle est de 0.709, ce qui montre que la compétence collective explique 70.9 % de la variance de la compétence individuelle. Le $R^2$ pour la compétence organisationnelle est de 0.355, la compétence collective expliquant ainsi 35.5 % de la variance de la compétence organisationnelle. Encore une fois, les deux valeurs de $R^2$ sont modérées puisqu'elles se situent entre 0.5 et 0.75.

Dans le sous-modèle 3, le $R^2$ pour la compétence individuelle est de 0.269, ce qui montre que la compétence organisationnelle contribue à expliquer 26.9 % de la variance de la compétence individuelle. Le $R^2$ pour la compétence collective est de 0.359, indiquant que la compétence organisationnelle explique 35.9 % de la variance de la compétence collective. Ces valeurs de $R^2$ sont également considérées comme modérées, puisqu'elles sont supérieures à 0.25 mais inférieures à 0.75.

La taille de l'effet ($f^2$) fournit un éclairage complémentaire en quantifiant l'impact de la variable indépendante sur le coefficient de détermination ($R^2$) du construit dépendant (Hair et al., 2022). Un $f^2$ supérieur à 0,35 est considéré comme ayant un effet important, un $f^2$ supérieur à 0,15

comme un effet moyen, et un $f^2$ supérieur à 0.02 comme un effet faible (Geert van den Berg, 2024; Kock & Hadaya, 2018).

Dans le cadre de l'approche en deux étapes du PLS-SEM, les tailles d'effet ($f^2$) pour chaque variable indépendante dans les trois sous-modèles distincts ont été évaluées. La compétence individuelle joue un rôle plus important dans la formation de la compétence collective (2.442) que de la compétence organisationnelle (0.369). La compétence collective joue un rôle plus important dans la formation de la compétence individuelle (2.395) que de la compétence organisationnelle (0,560). Enfin, la compétence organisationnelle joue un rôle plus important dans la formation de la compétence collective (0.552) que de la compétence individuelle (0.388). Il est à noter que toutes les variables indépendantes présentent des valeurs de $f^2$ supérieures à 0.35, ce qui indique que chacune a un effet important sur le coefficient de détermination de leurs construits dépendants respectifs.

**Chapitre 5: Discussion et conclusions**

En ce qui concerne la manière dont la compétence individuelle est représentée à travers le travail d'équipe (TW), la communication personnelle (PC), et les relations et engagements (RE), l'analyse a révélé que toutes ces relations sont fortes et statistiquement significatives, avec des charges factorielles supérieures à 0.6 et des valeurs t supérieures à 1.96.

Dans le construit travail d'équipe (TW), deux indicateurs se sont démarqués comme particulièrement significatifs dans l'ensemble des sous-modèles : TW_3 (*Je soutiens, facilite et révise le développement de l'équipe et de ses membres)* et TW_5 : *(Je reconnais les erreurs pour favoriser l'apprentissage à partir des fautes commises).* Ces résultats mettent en lumière l'importance d'un environnement d'équipe psychologiquement sécuritaire, où les individus se sentent suffisamment en confiance pour reconnaître leurs erreurs, offrir des rétroactions constructives, et s'engager dans un apprentissage continu. Selon Edmonston (1999), les employés qui perçoivent leur environnement de travail comme soutenant et non punitif sont plus enclins à voir les erreurs comme des occasions d'apprentissage et à rechercher activement de la rétroaction. À l'inverse, l'absence de sécurité psychologique peut entraîner une réticence à demander de l'aide, nuisant ainsi à la performance individuelle et d'équipe.

Ces comportements sont d'autant plus cruciaux dans les contextes de projet, où la collaboration, l'apprentissage rapide et l'adaptabilité sont essentiels. Dans ce contexte, les gestionnaires de projet et les chefs d'équipe jouent un rôle clé pour favoriser la confiance, l'ouverture et l'apprentissage. Tel que le souligne Anantatmula (2010), un leadership axé sur une communication claire, des processus cohérents et un soutien visible de la haute direction contribue fortement à établir la confiance, où l'apprentissage et le développement sont des priorités. Créer un environnement sécuritaire et structuré permet aux individus de se développer et d'avoir un impact positif sur la compétence collective de l'équipe de projet.

Dans le construit communication personnelle (PC), l'indicateur PC_3 (*Je facilite et favorise une communication ouverte*) a obtenu le poids le plus élevé parmi tous les indicateurs dans les trois sous-modèles. La communication interne est largement reconnue comme une activité essentielle qui peut motiver les employés, favoriser la confiance, renforcer l'identité commune, accroître l'engagement, permettre l'expression des émotions, le partage des aspirations, et la reconnaissance des réussites (Berger, 2008; Men, 2014).

Dans le construit relations et engagements (RE), l'indicateur RE_1 (*J'initie et développe des relations personnelles et professionnelles*) a reçu le poids le plus élevé dans les trois sous-modèles. Ces constats sont cohérents avec la littérature actuelle, qui souligne l'importance du développement des relations pour favoriser des résultats positifs tant au niveau individuel qu'organisationnel (Boyatzis, 2007). Notamment, des relations solides entre les leaders et les membres de l'équipe sont liées à une satisfaction professionnelle accrue, de meilleures performances, et des échanges de qualité entre le gestionnaire et les membres de l'équipe (Kwak & Jackson, 2015; Nahrgang et al., 2009).

En ce qui concerne la manière dont la compétence collective est représentée à travers la proactivité (PRO), la communication (COMM), la coopération (COOP) et les relations interpersonnelles (IR), l'analyse a également révélé que toutes ces relations sont fortes et statistiquement significatives, avec des charges factorielles supérieures à 0.6 et des valeurs t supérieures à 1.96.

Dans le construit proactivité (PRO), trois indicateurs se sont démarqués comme particulièrement significatifs: PRO_4 (*Lorsque j'ai des problèmes, mes collègues m'aident*

*habituellement).* PRO_7 *(Mes collègues participent aux décisions de l'équipe avec leurs suggestions) et* PRO_9 : *(Dans notre équipe, les collègues partagent habituellement leurs connaissances).* Ces résultats sont cohérents avec les travaux de Macke and Crespi (2016), qui ont également identifié la proactivité comme le facteur le plus significatif influençant les perceptions d'équipe à propos de la compétence collective. Dans leur étude portant sur les équipes TI, les auteurs suggèrent que cela pourrait s'expliquer par la nature même du travail en TI, qui met souvent l'accent sur les tâches techniques individuelles, au détriment des interactions sociales, rendant ainsi la communication et la collaboration plus difficiles, surtout lorsqu'il s'agit d'interagir avec des clients ou des parties prenantes non techniques.

Par conséquent, les dimensions de communication (COMM), coopération (COOP) et relations interpersonnelles (IR) exerçaient une influence comparativement plus faible sur la compétence collective dans leur étude. Fait intéressant, dans le contexte de la présente étude, 23,7% des répondants ont déclaré travailler dans le secteur des technologies de l'information ou du développement logiciel, ce qui pourrait expliquer l'importance similaire accordée à la proactivité.

Dans le construit communication (COMM), l'indicateur COMM_1 (*Nous reconnaissons les situations tendues et en discutons avec les membres de l'équipe*) a reçu le poids le plus élevé dans les trois sous-modèles. Cela indique que la capacité à aborder les tensions et à partager ouvertement durant les moments difficiles est une composante importante de la communication au sein des équipes. Cela reflète la valeur accordée à la gestion des conflits au sein d'une équipe. Ces résultats s'alignent avec les travaux actuels sur le conflit au sein des équipes de projet, qui soulignent que des mécanismes de communication efficaces sont essentiels pour prévenir et gérer les conflits (Akiner, 2014; Business, 2019; Macke & Crespi, 2016).

Dans le construit coopération (COOP), deux indicateurs se sont révélés particulièrement significatifs: COOP_1 (*Nous portons attention aux humeurs dans notre équipe) et* COOP_4 *(Dans notre équipe, nous reconnaissons les efforts de nos collègues).* Ces indicateurs mettent en lumière les aspects émotionnels de la coopération, soulignant l'importance de l'empathie, de l'intelligence émotionnelle, et de la reconnaissance mutuelle dans un environnement de travail coopératif, des facteurs qui ont démontré leur impact positif sur la performance des équipes (Abid et al., 2022;

Hwang, 2024). Notamment, COOP_1 faisait également partie des variables principales associées à la coopération dans l'étude de Macke and Crespi (2016).

Dans le construit relations interpersonnelles (IR), l'indicateur IR_1 (*Mes collègues comprennent mes forces et mes faiblesses*) est ressorti comme l'indicateur le plus fort dans les trois sous-modèles. Cela suggère que la connaissance des capacités individuelles au sein d'une équipe joue un rôle clé dans la perception des relations interpersonnelles. Lorsque les membres d'une équipe comprennent les forces et les faiblesses des uns et des autres, cela favorise un climat de confiance et de sécurité psychologique, ce qui encourage le partage ouvert d'idées (Edmonston, 1999). Cela mène également à une meilleure performance collaborative et à une prise de décision plus efficace (Salas et al., 2015). IR_1 avait également été identifié dans l'étude initiale de Macke and Crespi (2016) comme une variable clé liée aux relations interpersonnelles.

En ce qui concerne la manière dont la compétence organisationnelle est représentée à travers les exigences en compétences humaines (PCR), l'état des compétences humaines (PCS), l'acquisition des compétences humaines (PCA) et le développement des compétences humaines (PCD), l'analyse a révélé que toutes ces relations sont fortes et statistiquement significatives, avec des charges factorielles supérieures à 0.6 et des valeurs t supérieures à 1.96.

Dans le construit exigences en compétences humaines (PCR), deux indicateurs se sont démarqués dans les trois sous-modèles: PCR_3 (*L'organisation fournit des normes, règlements ou lignes directrices pour définir, planifier et contrôler les exigences en matière de compétences des personnes)* et PCR_5 (*Tous les gestionnaires et membres de projets, programmes et portefeuilles fournissent de la rétroaction et des suggestions pour l'amélioration continue des exigences en matière de compétences et de la norme associée)*. Ces résultats valident l'importance d'avoir des processus formalisés pour la gestion des compétences, ainsi que des mécanismes de rétroaction continue et d'amélioration, particulièrement dans les organisations orientées projets. Étant donné la nature dynamique de l'affectation des ressources en contexte de projet, où les individus changent souvent d'équipe, les évaluations à des jalons clés (comme à la fin d'un projet ou lors d'un changement de rôle) sont essentielles pour identifier les lacunes en compétences et réaligner les capacités individuelles avec les besoins organisationnels (Huemann et al., 2007; Turner et al., 2000). De plus, la valorisation des leçons apprises et la formalisation des bonnes pratiques à

travers les procédures de gestion de projet internes permettent de retenir les connaissances et de renforcer l'apprentissage organisationnel (Turner et al., 2000).

Dans le construit état des compétences humaines (PCS), l'indicateur PCS_3 (*L'organisation fournit des normes, règlements ou lignes directrices pour analyser, identifier et évaluer l'état des compétences des personnes*) était le plus significatif dans les trois sous-modèles. Ces résultats mettent en lumière l'importance d'avoir des processus d'évaluation formalisés pour mesurer le niveau actuel des compétences. Une approche structurée permet à l'organisation de mieux comprendre les capacités de sa main-d'œuvre, d'identifier les besoins en formation et de soutenir le développement des talents. Selon Marsick and Watkins (2003), des mécanismes d'évaluation systémique favorisent à la fois l'apprentissage individuel et la capacité organisationnelle à apprendre et à évoluer. De même, Sense (2007) soutient que les organisations qui valorisent l'apprentissage continu doivent intégrer des pratiques réflexives et évaluatives dans leur environnement de projet.

Dans le construit acquisition des compétences humaines (PCA), l'indicateur PCA_1 (*L'organisation fournit des normes pour identifier, évaluer, sélectionner et affecter les personnes (ex. : centre d'évaluation de recrutement et affectation d'emploi)*) s'est révélé être le plus fort dans les trois sous-modèles. Cela souligne l'importance d'avoir des processus de sélection standardisés au sein de l'organisation pour affecter les bonnes personnes aux bons projets, particulièrement dans les organisations orientées projet, où les affectations sont temporaires et les besoins en personnel varient fréquemment. Huemann et al. (2007) ont proposé un modèle de gestion des ressources humaines adapté à ce type d'organisation, qui permet de maintenir un bassin de personnel de projet qualifié. Cette approche permet aux organisations la possibilité de mobiliser un bassin de talents déjà évalués, assurant ainsi que les personnes ayant les compétences appropriées soient assignées aux bons projets au bon moment.

Dans le construit développement des compétences humaines (PCD), l'indicateur PCD_3 (*L'organisation évalue les résultats du développement des compétences des personnes*) est ressorti comme le plus fort dans les trois sous-modèles. Ces résultats soutiennent la littérature existante qui plaide en faveur d'un développement des compétences intentionnel et intégré à la stratégie organisationnelle. Cela implique des initiatives structurées, telles que des programmes de

formation formels, du coaching, du mentorat, et d'autres activités de développement alignées sur les besoins évolutifs de l'organisation (Crawford, 2005; Egginton, 2012; Sense, 2007; Turner et al., 2008). De plus, les résultats soulignent l'importance non seulement d'offrir ces opportunités d'apprentissage, mais aussi d'en valider l'efficacité afin d'assurer un apprentissage organisationnel à tous les niveaux. Cela est aussi en accord avec Marsick and Watkins (2003), qui soutiennent que l'apprentissage organisationnel nécessite à la fois une croissance individuelle et la capacité de l'organisation à soutenir et promouvoir cet apprentissage. Leur cadre fournit une approche pratique pour évaluer si l'apprentissage se produit à la fois au niveau individuel et organisationnel.

Cette étude apporte plusieurs contributions théoriques importantes au domaine des compétences en gestion de projet. Premièrement, en tant qu'étude exploratoire, elle constitue un point de départ pour valider les relations bidirectionnelles entre les niveaux individuel, collectif et organisationnel de la compétence. Une grande partie de la recherche existante s'est principalement concentrée sur le niveau individuel, souvent en mettant l'accent sur le rôle du gestionnaire de projet. Cette étude démontre que la compétence est un construit influencé par plusieurs niveaux. En fournissant des preuves empiriques de ces interconnexions, la recherche fait progresser la compréhension théorique de la compétence dans des environnements orientés projet, laquelle est aussi influencée par la compétence collective et la compétence organisationnelle (Ruuska & Teigland, 2009; Ruuska & Vartiainen, 2003).

Deuxièmement, cette étude comble un vide important dans la littérature en adoptant une perspective multiniveau de la compétence en gestion de projet. Les recherches antérieures ont largement examiné la compétence au niveau individuel, sans tenir compte du contexte plus large dans lequel les individus et les équipes évoluent. En examinant explicitement les relations entre les compétences individuelles, collective et organisationnelle, cette recherche élargit la portée des cadres existants en matière de compétence et soutient les perspectives multiniveaux proposées notamment par Wiewiora et al. (2019) et Melkonian and Picq (2011). Globalement, une approche multiniveau offre une perspective plus riche et plus complète sur la manière dont la réussite d'un projet est influencée non seulement par les capacités individuelles, mais aussi par les dynamiques d'équipe et les systèmes organisationnels. Cette étude répond directement aux appels de chercheurs comme Geraldi and Soderlund (2018) ainsi que Loufrani-Fedida and Missonier (2015), qui ont plaidé pour une analyse multiniveau en recherche dans le domaine de la gestion de projets.

Enfin, cette étude propose un cadre conceptuel multiniveau complet pour comprendre les compétences en gestion de projet. En s'appuyant sur des expériences issues de divers secteurs et en intégrant les perspectives de praticiens occupant des rôles et à des stades de carrière variés, le cadre reflète la complexité des environnements réels de projet. Notamment, l'étude favorise une compréhension plus inclusive de la compétence en gestion de projet, en dépassant le focus traditionnel sur les gestionnaires de projet. Elle reconnaît que le succès d'un projet repose également sur les compétences de divers types d'acteurs, y compris les membres de l'équipe et les intervenants organisationnels, tout au long du cycle de vie du projet. Elle soutient ainsi les arguments de Loufrani-Fedida and Missonier (2015), ainsi que Napier et al. (2009), qui remettent en question l'idée que le gestionnaire de projet est seul responsable des résultats du projet.

Cette étude offre aussi plusieurs pistes pratiques pour les organisations par projet qui souhaitent améliorer leurs résultats grâce à une approche plus globale du développement des compétences. Traditionnellement, la gestion de projet met l'accent sur la compétence individuelle, en particulier celle du gestionnaire de projet. Toutefois, les résultats de cette recherche soulignent l'importance de comprendre comment les compétences individuelle, collective et organisationnelle sont interconnectées et se renforcent mutuellement. En fait, reconnaître ces relations peut favoriser un changement de perspective organisationnelle, vers une vision plus holistique du succès de projet, une vision qui valorise autant les équipes et les systèmes organisationnels que les capacités individuelles.

En conséquence, les organisations devraient élargir leurs stratégies de développement des compétences. En plus de soutenir le développement individuel, elles devraient investir dans la collaboration d'équipe et renforcer les structures organisationnelles de soutien. Cela inclut la promotion d'une culture d'apprentissage continu, l'adoption de pratiques de leadership collaboratif et la mise en place de politiques et de procédures qui appuient à la fois la collaboration en équipe et l'apprentissage organisationnel. En investissant dans tous les niveaux de compétence, les organisations peuvent créer un environnement propice au développement de la compétence à tous les niveaux, ce qui se traduit par une livraison de projets plus cohérente et plus réussie.

De plus, ces résultats offrent une occasion de repenser les systèmes traditionnels d'évaluation de la performance. Plutôt que de se concentrer uniquement sur la compétence

individuelle, les organisations devraient intégrer l'évaluation de la collaboration en équipe et des contributions organisationnelles dans leurs cadres d'évaluation. Cette approche multiniveau permettrait de reconnaître et d'encourager les comportements qui non seulement améliorent la performance individuelle, mais valorisent aussi le travail d'équipe, la responsabilité partagée, et une vision systémique des projets.

Finalement, l'étude souligne l'importance pour les organisations d'investir dans des structures et des politiques qui non seulement attirent des individus et des équipes compétents, mais aussi favorisent leur développement tout au long de leur carrière. Il est tout aussi essentiel de donner à ces individus et équipes le pouvoir de contribuer activement à l'amélioration organisationnelle, par exemple en fournissant des rétroactions sur les politiques et les processus. Cette approche garantit que la compétence se développe à la fois par une démarche descendante (*top-down*) et ascendante (*bottom-up*). En permettant aux individus d'influencer leur environnement de travail et en maintenant une culture qui valorise la croissance à tous les niveaux, les organisations peuvent soutenir un cycle continu de développement des compétences à l'échelle de toute l'organisation.

Bien que cette recherche offre des perspectives théoriques et pratiques précieuses, elle reconnaît aussi plusieurs limites qui peuvent influencer l'interprétation des résultats et leur généralisation. Premièrement, la validité discriminante pour les construits de premier ordre à travers les trois sous-modèles n'a pas été satisfaisante. Cette limite suggère que certains construits peuvent se chevaucher conceptuellement, indiquant un manque potentiel de clarté ou de distinction entre les dimensions de compétence étudiées. Ce chevauchement a pu affecter la fiabilité du modèle de mesure. Des études futures devraient envisager de raffiner ou de revalider ces construits afin d'assurer une meilleure distinction entre eux.

Deuxièmement, la taille et la composition de l'échantillon peuvent poser des limites. En tant qu'étude exploratoire, cette recherche s'est appuyée sur un échantillon relativement petit (N=101), principalement issu des secteurs des technologies de l'information et gouvernemental (48 % des répondants combinés). Bien que cela puisse fournir un aperçu initial des environnements basés sur des projets, cet échantillon ne représente peut-être pas adéquatement la diversité des contextes projet à travers les industries, régions géographiques ou types

d'organisation. Les recherches futures devraient viser à élargir la base d'échantillonnage pour inclure des participants de milieux divers, provenant de secteurs variés, de différentes tailles d'organisation et de contextes culturels multiples. De plus, des analyses comparatives par sous-groupes selon les rôles, secteurs ou niveaux d'expérience pourraient offrir des éclairages plus nuancés sur le développement des compétences selon les contextes projet.

Troisièmement, l'étude s'est basée sur des données d'enquête autodéclarées, qui reflètent la perception subjective de la compétence par le répondant. Cette méthode fournit des informations précieuses sur les expériences individuelles, mais ces perceptions peuvent être biaisées et influencées par des facteurs démographiques tels que l'âge, l'expérience ou le rôle, pouvant affecter la façon dont les questions sont comprises et répondues. Les recherches futures pourraient bénéficier d'une approche méthodologique mixte, incorporant des données de performance objectives pour valider les mesures autorapportées.

Par ailleurs, la portée de l'étude a été délibérément limitée à un sous-ensemble de construits pour chaque niveau de compétence, afin d'assurer la faisabilité de la conception et de l'analyse de l'enquête. Bien que cette approche soit nécessaire pour gérer l'étendue de la recherche, elle limite la capacité à généraliser les résultats à un ensemble plus large de construits dans le cadre théorique. De plus, la recherche a été limitée à trois niveaux définis de compétence: individuel, collectif (équipe projet) et organisationnel. Des études futures pourraient étendre ce cadre multiniveau pour inclure d'autres niveaux, tels que l'inter-équipe (niveau programme ou portefeuille) ou la collaboration inter-organisationnelle, qui est de plus en plus pertinentes dans des environnements de projet complexes.

La portée de l'étude a aussi délibérément limité l'analyse aux associations simples entre variables, plutôt que d'explorer les relations combinées entre les trois niveaux de compétence. Étant donné la complexité d'interprétation des variables multiples interconnectées, cette recherche s'est concentrée sur la corrélation entre paires de variables pour mieux isoler et comprendre l'influence de chaque variable.

Enfin, bien que cette étude ait identifié des relations réciproques entre les niveaux de compétence, elle n'a pas explicitement testé ou mesuré les mécanismes par lesquels ces relations sont facilitées. La littérature existante, notamment Wiewiora et al. (2019), souligne l'importance

des mécanismes de liaison, tels que les modèles mentaux partagés, les réseaux, la rétroaction, le style de leadership, la culture organisationnelle et les dynamiques politiques internes, comme facteurs clés facilitant le transfert de connaissances entre les niveaux individuel, collectif et organisationnel. Bien que ces mécanismes aient servi de références utiles pour interpréter les différences de force des relations, ils n'ont pas été testés empiriquement. Les recherches futures devraient chercher à examiner empiriquement le rôle médiateur ou modérateur de ces facteurs contextuels afin de mieux comprendre les conditions qui facilitent ou empêchent le développement des compétences à travers les niveaux. Par ailleurs, des études longitudinales pourraient offrir des éclairages précieux sur l'évolution de ces relations dans le temps, notamment en réponse aux changements organisationnels ou au cycle de vie des projets.

## TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

## LIST OF ABBREVIATIONS

| | |
|---|---|
| APM | Association for Project Management |
| AVE | Average Variance Extracted |
| CAF | Canadian Armed Forces |
| COMM | Communication |
| COOP | Cooperation |
| CR | Composite Reliability |
| CPM | Critical Path Method |
| CR | Cronbach's Alpha |
| DND | Department of National Defence |
| ICB | Individual Competency Baseline |
| IR | Interpersonal Relationship |
| IPMA | International Project Management Association |
| KSA | Knowledge, skills, abilities |
| MPC | Making Projects Critical |
| OCB | Organizational Competence Baseline |
| PBO | Project Based Organization |
| PC | Personal Communication |
| PCA | People's Competences Acquisition |
| PCD | People's Competences Development |
| PCR | People's Competences Requirements |
| PCS | People's Competences State |
| PERT | Project Evaluation Review Technique |
| PLS | Partial Least Squared |
| PLS-SEM | Partial Least Squared Structured Equation Modeling |
| PMBOK | Project Management Body of Knowledge |
| PMCD | Project Manager Competency Development |
| PMI | Project Management Institute |
| PMO | Project Management Office |
| PP&P | People, Practice & Perspective |

| | |
|---|---|
| PRO | Proactivity |
| RE | Relationships and Engagement |
| TW | Teamwork |
| VIF | Variance Inflation Factor |

# CHAPTER 1 : GENERAL INTRODUCTION

Chapter 1 establishes the background information and general context for this study. The purpose is to examine the evolution of the project management discipline as well as the evolution of project management competence, map the research landscape, and identify any gaps and opportunities that need further attention. The chapter concludes with a main research objective and main research question.

Section 1.1 explores the history of project management from its early beginnings until today. From there, Section 1.2 explains how project management competence has evolved in parallel with the increasing complexity of the project environment. Section 1.3 argues that although competence is a critical success factor, it remains a key challenge when dealing with complex projects. To better understand this challenge, Section 1.4 carries out a bibliometric analysis of the existing research with regards to project management competence. Here, two themes emerge in the literature: types of project management competence and how competence is shaped. Section 1.5 suggests that the existing research is overly focused on individual competence. Accordingly, a multilevel approach would provide a more comprehensive framework for understanding how project management competence is shaped. Section 1.6 identifies broader research fields to inform this multilevel competence study, including competence, temporary organizations, and process studies. Lastly, Section 1.7 presents the main research question for this study.

## 1.1 EXPLORING THE EVOLUTION OF PROJECT MANAGEMENT COMPETENCE AND ITS ASSOCIATED CHALLENGES

This section traces the history of project management in parallel with the evolution of project management competence. Two schools of thought on project management, mainstream project management and Making Projects Critical, reveal differing perspectives on the project, the role of the project manager, and the desired competence profile for the project manager. Ultimately, competence is recognized as a critical success factor in project management that remains a challenge today.

### 1.1.1 FROM THE EARLY BEGINNINGS OF PROJECT MANAGEMENT TO THE PROLIFERATION OF PROJECT-BASED ORGANIZATIONS

The early beginnings of project management can be traced all the way back to ancient history where evidence of project management efforts included the construction of the Great Wall of China, the Stonehenge and the Coliseum (Seymour & Hussein, 2014). While project management activities and processes were not formalized at that time, the principles of planning, coordination and organization were critical to the outcome of these projects (Seymour & Hussein, 2014). The approach to project management in this era was mostly trial and error but significant progress was made in the Middle Ages when the increase in specialized professions created a distinction between design and construction (Garel, 2013). As society evolved and became more complex, project management principles continued to develop with the construction of cathedrals, bridges and other large-scale projects requiring more sophisticated project management techniques and the coordination of hundreds of workers and specialized trades (Garel, 2013).

Modern project management emerged around the mid-twentieth century with the application of standardized tools and techniques to deal with increasingly complex projects. The transition from the end of World War II to the cold war stimulated the formalization of project management as "big, urgent, superimportant projects and programs" (Morris, 2013, p. 23) became more difficult to coordinate, especially in the US defence-aerospace sector (Garel, 2013; Morris, 2013). Notable projects include the Apollo space program, the F4 Phantom II project led by the US Navy and the Manhattan Project led by the US Army (Garel, 2013; Seymour & Hussein, 2014). During this time, project management tools and techniques such as work breakdown structures, Gantt charts, Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT) were introduced to plan, organize, monitor, and control projects.

The development of project activities and their management needs led to the formalization of practices, the need for a collaborative community of practitioners and the recognition of developing specific project management skills. Thus, the Project Management Institute (PMI) emerged in 1969 to professionalize the project management discipline (Morris et al., 2006). Quickly becoming the world's largest professional association for project managers, it enabled information exchange within the community of practice and established standards for certification of the profession (Shepherd & Atkinson, 2011). Around the same timeframe, other professional

associations were established across the world including the International Project Management Association (IPMA) established in 1965 and the Association for Project Management (APM) founded in the UK in 1972. These professional associations went on to develop references for managing projects, establishing a common language and framework for project managers to use in their work. One of the most well-known references is the PMI's Project Management Body of Knowledge (PMBOK), which was first published in 1983 and covered basic concepts, principles, and techniques of project management (Morris et al., 2006). Over the next decade, IPMA, APM and other professional associations published their own unique bodies of knowledge for the profession (Shepherd & Atkinson, 2011). Ultimately, these professional associations and their bodies of knowledge played a vital role in advancing the project management profession and the competence of project managers.

Today, project management is an essential part of many industries, with project-based activities representing one third of Western economic activities and 40% of the overall global economy (Miterev et al., 2017; Schoper, 2018). Organizations are adopting project management as their primary means of managing work because it is a "key driver in their organisational performance" (Shepherd & Atkinson, 2011, p. 152). This reflects a phenomenon known as *projectification* (Midler, 1995), which has been gaining momentum in recent years and describes the significant organizational management shift from classic functional organizations to project-based organizations that "operate through projects as their main business model" (Zerjav, 2021). These project-based organizations are structured around projects, with teams of experts from different departments working together to achieve a specific goal. This approach allows organizations to be more flexible and responsive to changes in the business environment, since teams can be formed quickly to address new challenges or opportunities (Schoper, 2018). "Project-based ways of working have become increasingly necessary to deal with operations that are substantially unique, novel and transient, especially with the recent explosive development of markets, products and technologies" (Turner, 2001, p. 256).

### 1.1.2 TOWARDS A CRITICAL UNDERSTANDING OF THE NATURE OF COMPETENCE TO ADDRESS THE COMPLEXITY OF PROJECTS

As project-based organizations continue to trend, professionals across all industries are increasingly called upon to fulfill project management roles. Experts predict that by 2030, 25

million new project professionals will be required to meet the needs of the workforce (PMI, 2021b). "As organisations define more of their activities as projects, the demand for project managers grows, and there is increasing interest in project management competence" (Crawford, 2005, p. 7). Selecting the right person to fill the role of project manager is key to project success as they must balance the understanding of technical details while focussing on being an effective leader, organizer and decision-maker (Avots, 1969).

In parallel to the development of the discipline, the expectation of the competent project manager has also evolved over the years to include a wide range of technical and non-technical skills that reflect the complex environment of today's projects. Accordingly, this section examines the evolving understanding of the desired competence profile through the lens of two major research approaches in the field of project management: mainstream project management and Making Projects Critical (MPC). The following sub-sections analyze how these two distinct, yet complementary, approaches address and conceptualize projects, the role of the project manager and the desired competence profile, underscoring the shift towards a critical understanding of the nature of project management competence.

#### 1.1.2.1 MAINSTREAM PROJECT MANAGEMENT

The mainstream approach to project management appeared around the middle of the twentieth century and essentially emerged from the "ongoing standardization of processes, refinement of concepts, and development of software and applications" where "project management [was] becoming more of a science than art" (Seymour & Hussein, 2014, p. 237). During this time, technical skills were most valued as the CPM, PERT, Gantt charts and work breakdown structures were among the core techniques that emerged within the discipline to plan, organize, monitor and control projects (Stretton, 2007). The mainstream approach to project management persisted largely throughout the second half of the twentieth century with the emergence of professional associations such as PMI in North America and IPMA in Europe.

The mainstream project management research approach is deeply rooted in the functionalist/positivist paradigm (Cicmil, 2006; Cicmil & Hodgson, 2006; Cicmil et al., 2006). This paradigm embraces a 'being' ontology that views projects through the lens of an objective reality where they can be controlled and managed using specific tools and techniques (Bell &

Bryman, 2018; Cicmil & Hodgson, 2006; Le Deist & Winterton, 2007). In other words, projects are predictable and controllable, and the success or failure of a project depends on whether the objectives of scope, quality, cost, and schedule have been achieved (Pinto & Slevin, 1988). In this perspective, the activities of project management revolve around managing and controlling project scope, project organization, quality, cost and time (Turner, 2006). Accordingly, this approach focuses on the technical aspects of project management such as planning, scheduling, budgeting, risk management and resource allocation. The functionalist/positivist paradigm is closely linked to quantitative research approaches, which has traditionally dominated the field of project management (Cicmil & Hodgson, 2006). The mainstream project management approach is commonly used in industries such as construction, engineering, and defence (Pollack, 2007).

Critical success factors in this approach include scheduling activities, allocating resources, defining requirements, executing technical tasks and assessing performance (Pinto & Slevin, 1986). Thus, project managers are expected to possess a competence profile that primarily includes technical skills. These technical skills enable them to apply appropriate tools and techniques to ensure that projects are delivered on time, within budget and scope, and quality standards.

Mainstream project management research focuses on technical competence, which is prevalent across numerous studies. Crawford and Pollack (2004) identified five key technical competences that are critical for project managers: project planning and control, risk management, quality management, stakeholder management, and team management. Eight of the twelve critical success factors identified by Cooke-Davis (2004) also involved technical competence. Bashir et al. (2021) identified scope, planning and cost estimation among the top five most required competences for the planning phase. "As a whole, research into projects and project management remains heavily reliant on a functionalist, instrumental view of projects and organisations, where the function of project management is taken to be the accomplishment of some finite piece of work in a specified period of time, within a certain budget, and to agreed specifications" (Cicmil & Hodgson, 2006, p. 111).

The main challenge with the mainstream approach to project management is its assumption that the role of the project manager is limited to implementation rather than acknowledging their

"wider potential role as competent social and political actors in complex arrangements structured as projects" (Cicmil et al., 2006, p. 679). In fact, El-Sabaa (2001) reveals that technical skills are the least essential project manager skill. Likewise, Tereso et al. (2014) show that behavioural competence has a higher influence than technical skills on project success. "[Mainstream] methods and techniques can be a useful source of guidance for certain aspects, but they provide no guidance on 'how' to navigate the complexity of projects in the ever-changing flux of events" (Winter et al., 2006, p. 645). Similarly, Geraldi et al. (2008) posit that "the phenomenon of a project demands more than just dreaming of structure, it demands a 'non-discipline', which looks into the chaotic reality of projects and proposes feasible ideas to deal with this reality" (p. 588). Accordingly, a more critical interpretation of projects recognizes that project managers navigate complex social and political environments while still ensuring that the project is delivered on time and within budget.

#### 1.1.2.2 MAKING PROJECTS CRITICAL (MPC)

At the beginning of the twenty-first century, there was a growing recognition that traditional project management competence and methodologies fell short in dealing with uncertainty and change (Geraldi & Lechter, 2012). The PMBOK was criticized as promoting implicit trust in knowledge, tools and techniques and was thought of as disregarding reflexive rationality (Hodgson & Cicmil, 2006). In other words, since existing project management tools and techniques were designed for a more stable and predictable environment, they did not adequately address the challenges of social, political, and ethical contexts at the heart of complex projects. Attention was drawn to the limitations of the mainstream approach to project management with the argument that "the instrumental rationality in decision-making and control…does not eliminate project failures, nor does it guarantee project success" (Cicmil & Hodgson, 2006, p. 114). Thus, in order to overcome the mainstream project management crisis, there was a need to broaden the role of project managers from implementers to "competent social, political and ethical actors" (Cicmil et al., 2009, p. 86).

The Making Projects Critical (MPC) movement emerged as a response to what was perceived as a narrow and overly technical focus in the mainstream approach to project management. MPC was driven by a group of interdisciplinary scholars who wanted to challenge the dominant assumptions and values of project management and promote a more critical and

reflexive approach to projects (Hodgson & Cicmil, 2016). MPC draws on a range of theoretical perspectives including critical social theory to develop new frameworks and methods for studying projects that emphasize the importance of reflexivity, dialogue and critical inquiry in understanding projects and their impact (Cicmil & Hodgson, 2006)

Given that MPC is heavily influenced by the critical theory paradigm, it offers a distinct ontology and epistemology compared to the mainstream functionalist/positivist paradigm. From an ontological perspective, the MPC movement recognizes that project realities are shaped by broader social, cultural, economic, and political contexts. MPC also encourages reflexivity, which is the process of recognizing and reflecting on researcher and participant subjectivities, biases, and power as their perspectives influence knowledge creation. MPC often employs qualitative research methods in the form of in-depth interviews and participant observation to gain richer insight into social dynamics and power relations within projects.

The MPC movement has important implications for the development of project management competence that requires a transition from practitioners as trained technicians who control the project towards reflective practitioners and a closer link between practical knowledge and learning processes in the development of project managers (Cicmil et al., 2006; Winter et al., 2006). "It is people who deliver successful projects, not methods and tools, and it is people's ability to engage intelligently with the complexity of projects, that is central to the successful management of projects" (Winter et al., 2006, p. 646). Reflective practitioners recognize the value of tacit knowledge and critically reflect on their experiences and actions, challenge ongoing discourses and power relations and engage in continuous learning to improve the professional practice (Winter et al., 2006). Thus, a critical version of the project management competence profile requires skills that prepare a project manager to navigate the complex project environment and its uncertainty, ultimately moving away from the mainstream perspective that embraces technical skills to control the project:

> "The distinguishing feature of project managers is not control but the ability to operate effectively, and to individually and collectively maintain their sense of self and their defenses against uncertainty… It also means departing from the image of rational, purposeful, knowledgeable, professional manager, who makes sense of what is happening

in the organization on the basis of information, then rationally analyzes the situation, and designs the system of action that will ensure desired outcomes" (Cicmil, 2006, p. 35).

Accordingly, in the last few decades, the trend in the literature has shifted towards non-technical competence as researchers attempt to shed light on the wide range of skills expected of the project manager. This includes a focus on competences such as communication skills, emotional intelligence, leadership, and teamwork, which are essential for project managers to succeed in today's complex and uncertain environment. Pant and Baroudi (2008) emphasize people-management skills such as stakeholder participation, effective team and external communication, customer satisfaction, conflict management, and staff management and motivation to manage the complex relationships forged with project team members and stakeholders. Leadership also emerges in the literature as an important competence with strong connections to teamwork and project success (Alvarenga et al., 2020; Muller & Turner, 2007; R. Muller & R. Turner, 2010; Yang et al., 2011). Similarly, emotional, and cultural intelligence have shown to play a positive role on the success of certain types of projects (Clarke, 2010a; Lima & Quevedo-Silva, 2020; Yazdanshenas, 2021; Zhu et al., 2021). Finally, certain personality types are better suited to specific project types that contribute to project success, such as emotional stability in complex projects and extroversion in innovation-type projects (Bedingfield & Thal, 2008; Dvir et al., 2006).

Despite providing an alternative to the mainstream project management approach, the primary challenge with critical project management, which emphasizes non-technical skills, is the intangibility of non-technical competence (Nijhuis, 2018). For instance, adaptability and critical thinking are more abstract in nature and harder to measure objectively when compared to technical skills in project management. These non-technical skills are normally acquired through experiential learning and reflection and assessed through interviews and other subjective methods. Conversely, technical skills are typically developed through traditional learning methods and assessed and validated through professional certifications and course certificates, which clearly demonstrates the technical knowledge and abilities of the project manager. In short, the assessment methods for non-technical skills tend to be considered less rigorous and standardized.

#### 1.1.2.3 SUMMARY

Overall, mainstream project management and MPC are grounded in different paradigms that naturally offer unique perspectives on the project, the role of the project manager and the desired competence profile of the project manager. As summarized in Table 1-1 below, the mainstream project management approach embraces a functionalist/positivist paradigm where projects are predictable and controllable. In this approach, the project manager is a trained technician who develops technical skills through traditional learning methods and focuses on managing the traditional parameters of the project such as scope, quality, cost, and schedule. In comparison, the critical project management approach leverages a critical theory paradigm that recognizes the complexity of projects and acknowledges that they are influenced by social, cultural, and political contexts. In this approach, the project manager is a reflective practitioner who navigates and adapts to the complex project environment through the application of non-technical skills such as leadership, critical thinking, and effective communication that have been acquired through experiential learning.

| | **Mainstream Project Management** | **Making Projects Critical (MPC)** |
|---|---|---|
| **Paradigm** | Functionalist/Positivist | Critical theory paradigm |
| **Project perspective** | A project is predictable and controllable. | A project is a complex environment shaped by social, cultural, political contexts. |
| **The role of the project manager** | The project manager is a trained technician who follows procedures and applies project management tools and techniques to control the scope, quality, cost, and schedule of a project. | The project manager is a reflective practitioner who navigates and adapts to the complex project environment. |
| **The desired competence profile of the project manager to influence project success** | The desired competence profile for project success is focused on technical skills acquired through traditional learning methods. | The desired competence profile for project success is focused on non-technical skills acquired through experiential learning. |

Table 1-1: Summary of characteristics of mainstream project management and MPC

### 1.1.3 COMPETENCE REMAINS A KEY CHALLENGE IN SUCCESSFULLY DELIVERING COMPLEX PROJECTS

While the project management discipline and project manager competence have continued to evolve, organizations today still struggle to deliver successful project outcomes. According to a report published by PMI in 2021, project managers reported that 34% of projects in their organization experienced scope creep and 12% were deemed failures (PMI, 2021a). Similarly, the Standish Group's 2020 report found that only 31% of information technology projects were reported successful, 50% failed in either scope, schedule, or results and 19% of projects failed overall (StandishGroup, 2020). The findings in these reports are evidence that organizations are still challenged to deliver successful project outcomes.

Among the critical project success factors cited in the literature, competence consistently stands out as having a significant impact on project outcomes (Bedingfield & Thal, 2008; Belassi & Tukel, 1996; Crawford, 2000; Pinto & Slevin, 1987; Ruuska & Vartiainen, 2003). In the past, project management was largely viewed as a technical discipline, with project managers focusing primarily on planning, scheduling, budgeting, and other technical aspects of project management. As project environments have become increasingly complex, non-technical skills such as leadership and communication have become more valued. However, project management competence may not have sufficiently evolved to deal with the increasing complexity of project organizations. Accordingly, the following section carries out a bibliometric analysis to explore the current research landscape with regards to project management competence.

## 1.2 PERSPECTIVES IN THE CURRENT LITERATURE

This section begins with a bibliometric analysis of the current literature on project management competence. The challenges associated with developing the right set of project management competences is multifaceted as made evident by the findings of the bibliometric analysis that reveal a wide range of topics associated with project management competence. The remainder of the section focuses on two overarching themes derived from the bibliometric analysis. The first theme focuses on the competences expected from the project manager derived from the literature. Understanding the types of project management competence also requires us to question the way they are developed. Thus, the second theme explores how project management competence is shaped through traditional and experiential learning.

### 1.2.1 A BIBLIOMETRIC ANALYSIS OF PROJECT MANAGEMENT COMPETENCE LITERATURE REVEALS TWO OVERARCHING THEMES

To better understand the research landscape on project management competence, a search for relevant publications was conducted in the Scopus database using the following keywords: *project management* and *competenc**, where the asterix is used as a wildcard to represent any other characters. Given that there are multiple spelling variations of the word competence in the literature, using the wildcard ensured that they would be captured. The search was limited to the titles, abstracts, and keywords of the publications, which produced 2911 results. These initial results were then limited to journal articles to ensure the highest quality publications given that other types of publications such as conference proceedings are not necessarily peer reviewed. Additionally, only English publications were selected. Ultimately, the search yielded 1185 publications.

The bibliographic data was exported from Scopus and used to generate a map of keywords in VOSviewer. Figure 1-1 below displays the co-occurrence analysis of author keywords from the 1185 publications. A thesaurus file was used to eliminate similar keywords and replace them with one common keyword. For example, the terms *competence*, *competencies* and *competency* were replaced with *competences* because they were all assumed to refer to the same thing. Refer to Appendix 1 for the complete thesaurus file. Moreover, only keywords occurring a minimum of 5 times were retained. The analysis resulted in a total of 74 keywords with 420 links amongst each other.

By default, VOSviewer divided the 74 keywords into 11 clusters based on their connections with other keywords. Each cluster is formed by grouping keywords that have a close relationship with one another; thus, representing different topics in the existing research that are identified by a unique color in the Network Visualization in Figure 1-1 below. By adjusting the minimum cluster size to 10, the number of clusters was reduced to 5, which resulted in a more manageable number of clusters to analyze.

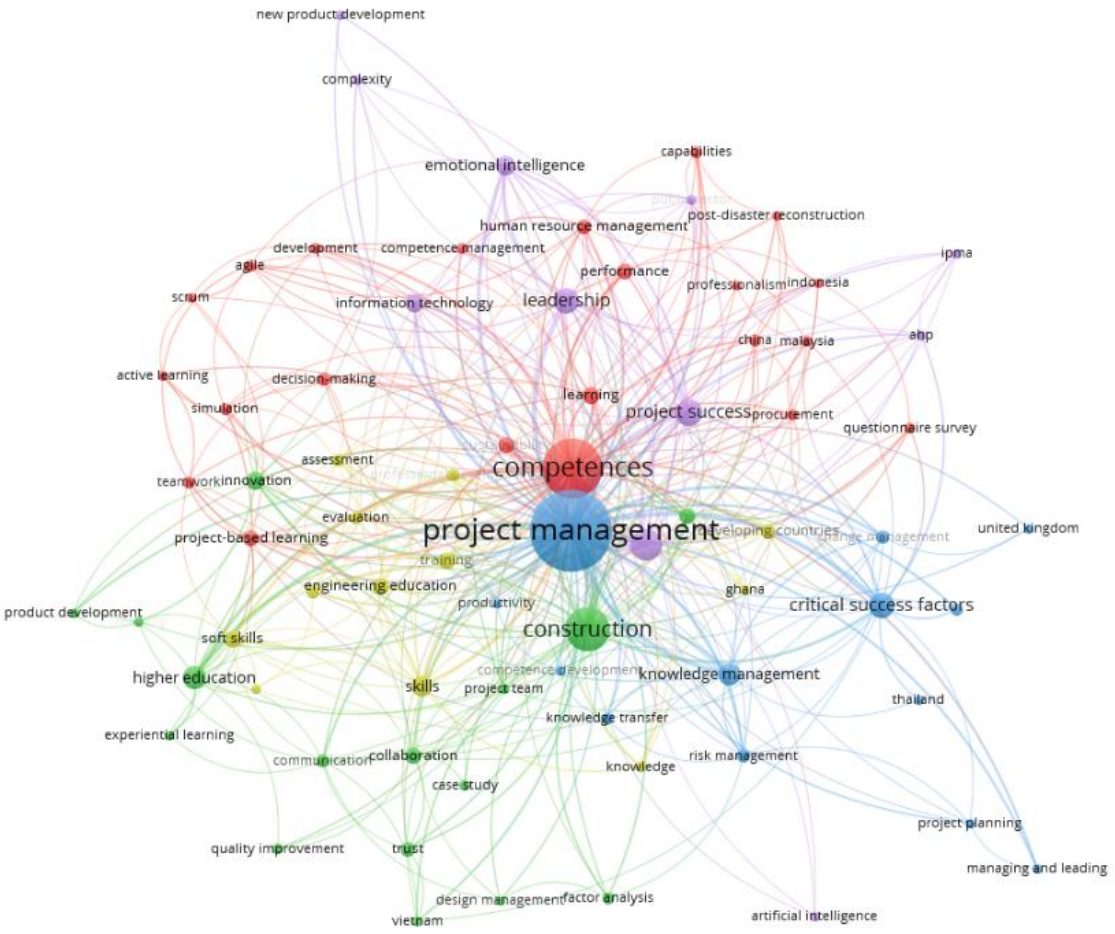



Figure 1-1: Network visualization of bibliometric analysis

Cluster 1 is identified in red and centers on competences and learning related to fields such as procurement and post-disaster reconstruction. It mentions specific areas like Malysia, Indonesia, and China. Cluster 2 is identified in green and emphasizes higher education and experiential learning to develop non-technical skills such as communication, collaboration, and trust amongst project teams. Its particular focus is on construction but also mentions other areas like innovation, creativity, and product development. This cluster appears to prioritize soft skills and teamwork. Cluster 3 is identified in blue and focuses on the development of technical competences such as risk management, project planning, and change management through knowledge management and knowledge transfer. This cluster seems to emphasize the importance of structured project management processes. Cluster 4 is identified in yellow and focuses on developing soft skills for projects in developing countries, likely addressing the unique challenges

and contexts of projects in these regions. Lastly, cluster 5 is identified in purple and emphasizes the development of emotional intelligence for leaders and project managers in the field of information technology. Appendix 2 contains the complete list of keywords grouped within these five clusters, providing further details and insights into the specific topics and competences covered within each cluster.

By examining patterns of related keywords across the five clusters, two overarching themes emerge: types of competences and how competence is shaped. These interrelated keywords serve as a bridge between the five clusters to provide a better understanding of the broader research trends within all the topics related to project management competence generated by the bibliometric analysis. The first theme encompasses a variety of keywords that highlight diverse types of technical and non-technical project management competence, including *competences, leadership, critical success factors, skills, emotional intelligence, soft skills, collaboration, human resource management, trust, communication, risk management, change management, teamwork,* and *project planning*.

The second theme focuses on keywords that capture the processes through which competences are developed. These keywords include *higher education, knowledge management, engineering education, training, learning, project-based learning, knowledge transfer, professional development, knowledge, competence management, experiential learning, active learning, competence development,* and *IPMA*. These keywords highlight various ways in which individuals acquire and enhance their project management competences ranging from professional development and formal education to practical training.

Table 1-2 summarizes the themes that emerged from the bibliometric analysis along with their associated keywords, the number of occurrences in the literature, and the average year of publication. This information can also be found in Appendix 2.

| | Themes | Keywords | Cluster | Occurrences | Avg Year of Publication |
|---|---|---|---|---|---|
| 1 | **Types of competences** | competences | 1 | 192 | 2014 |
| | | leadership | 5 | 37 | 2015 |
| | | critical success factors | 3 | 35 | 2016 |
| | | skills | 4 | 24 | 2018 |
| | | emotional intelligence | 5 | 20 | 2013 |
| | | soft skills | 4 | 17 | 2018 |
| | | collaboration | 2 | 14 | 2016 |
| | | human resource management | 1 | 13 | 2017 |
| | | trust | 2 | 12 | 2017 |
| | | communication | 2 | 11 | 2015 |
| | | risk management | 3 | 11 | 2018 |
| | | change management | 3 | 11 | 2011 |
| | | teamwork | 1 | 8 | 2012 |
| | | project planning | 3 | 5 | 2015 |
| 2 | **How competences are shaped** | higher education | 2 | 30 | 2015 |
| | | knowledge management | 3 | 27 | 2012 |
| | | engineering education | 4 | 17 | 2015 |
| | | training | 4 | 17 | 2013 |
| | | learning | 1 | 16 | 2010 |
| | | project-based learning | 1 | 15 | 2015 |
| | | knowledge transfer | 3 | 8 | 2014 |
| | | professional development | 4 | 8 | 2009 |
| | | knowledge | 4 | 7 | 2018 |
| | | competence management | 1 | 7 | 2013 |
| | | experiential learning | 2 | 6 | 2019 |
| | | active learning | 1 | 6 | 2016 |
| | | competence development | 3 | 5 | 2014 |
| | | IPMA | 5 | 5 | 2016 |

Table 1-2: Two overarching themes from the bibliometric analysis

The bibliometric analysis also uncovers keywords that help to understand different parameters associated with the existing research, which are detailed in Table 1-3: below. The *keywords construction, information technology*, *new product development* and *public sector* characterize fields of study. The keywords *developing countries, china, malaysia, thailand, ghana, vietnam, indonesia*, and *united kingdom* represent different countries that served as focal points in the studies. Finally, the keywords *case study* and *questionnaire survey* describe some of the research methods used in different studies on project management competences. Overall, these results show a notable concentration of research on competence within the construction industry. Moreover, there appears to be a distinct interest in both developing countries and countries situated in Asia and Africa.

| Research Parameters | Keywords | Occurrences | Avg Year of Publication |
|---|---|---|---|
| Fields of study | construction | 104 | 2016 |
| | information technology | 18 | 2014 |
| | procurement | 8 | 2013 |
| | post-disaster reconstruction | 6 | 2012 |
| | new product development | 5 | 2013 |
| | public sector | 5 | 2018 |
| Countries studied | developing countries | 12 | 2015 |
| | china | 9 | 2011 |
| | malaysia | 7 | 2013 |
| | thailand | 6 | 2011 |
| | ghana | 5 | 2010 |
| | vietnam | 5 | 2014 |
| | indonesia | 5 | 2016 |
| | united kingdom | 5 | 2011 |
| Types of studies | case study | 7 | 2013 |
| | questionnaire survey | 7 | 2017 |

Table 1-3: Research parameters that emerged from the bibliometric analysis

The remainder of section 1.2 focusses on exploring the two overarching themes using the relevant literature within the 618 publications associated with the keywords in Table 1-2 as a starting point. Given the large volume of publications available, the intent is not to carry out a rigorous systematic literature review but rather to provide a general overview of the research landscape regarding project management competences. As such, articles were selected based on their online availability as well as their relevancy to the topic. The entire bibliometric analysis process is summarized in Figure 1-2 below.

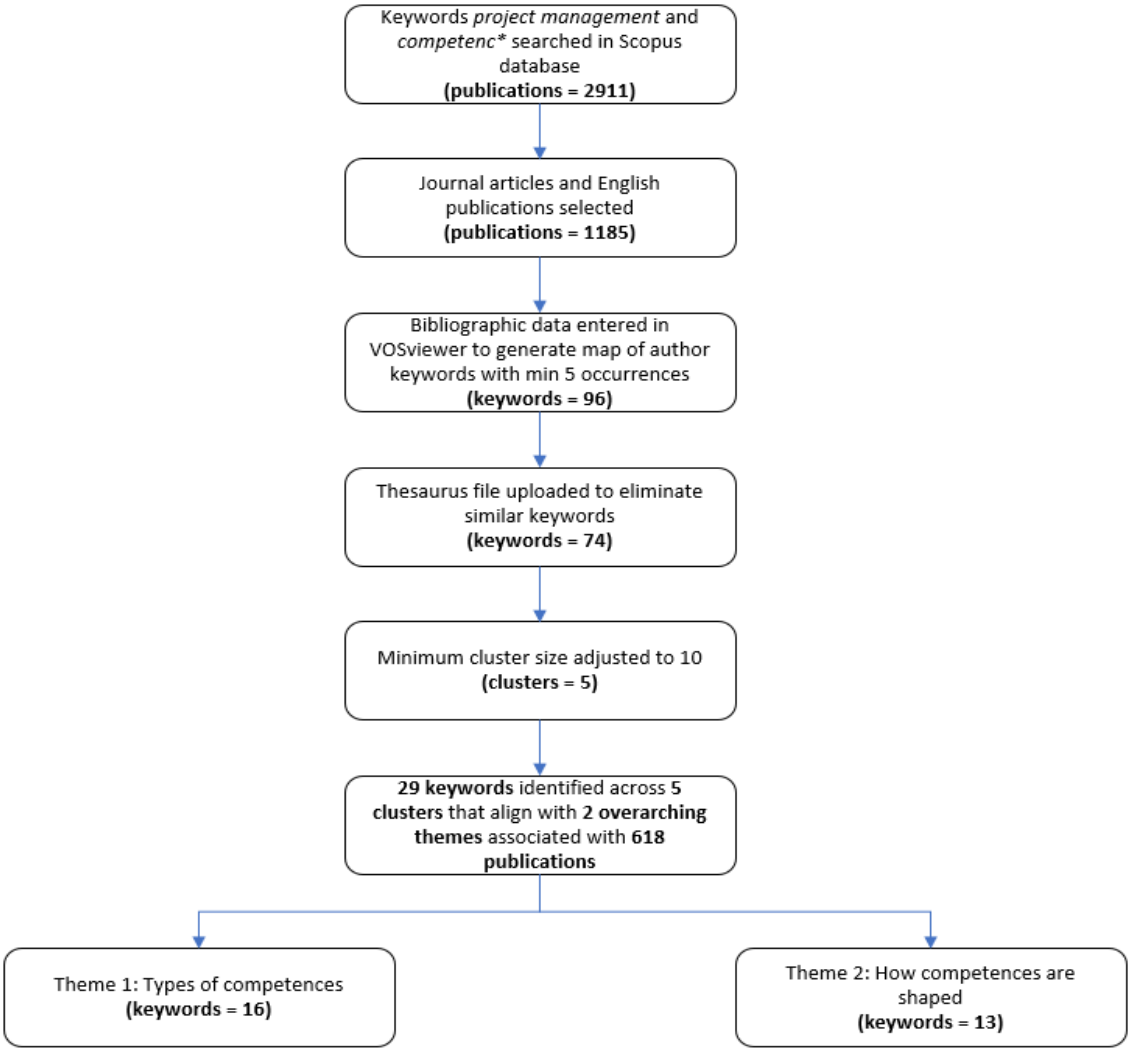



Figure 1-2: Bibliometric analysis process

### 1.2.2 THEME 1: TYPES OF COMPETENCES

The first theme centers on a range of keywords that encompass diverse types of competences such as *competences, leadership, critical success factors, skills, emotional intelligence, soft skills, collaboration, human resource management, trust, communication, risk management, change management, teamwork,* and *project planning.* This set of keywords shows that project management competences thought to influence project success encompass a wide spectrum of skills. Consequently, this section maps existing research into two broad categories: 1. Individual project manager competences; and 2. Collective and organizational competences.

#### 1.2.2.1 INDIVIDUAL PROJECT MANAGER COMPETENCE

Most of the existing literature focuses on identifying individual project manager competence. For instance, several studies have explored the dynamics of leadership skills and their influence on project success as it is considered one of the most critical competences for project managers (Liikamaa, 2015; Moyo & Chigara, 2021). This aligns with the 37 instances of the keyword l*eadership* identified in the bibliometric analysis (see Table 1-2). R. Muller and J. R. Turner (2010) profile leadership competences and leadership styles of successful project managers based on project type. The results of their study show that leadership profiles encompassing intellectual, managerial, and emotional competences, which are required for project success, vary based on the nature of the project. Similarly, leadership competences need to be tailored based on project complexity (Muller et al., 2012). Moreover, distinct leadership competences are associated with different aspects of project success (Muller & Turner, 2012). Intellectual competence, for instance, influences project success metrics such as scope, schedule, quality and cost, whereas managerial competence influences how project stakeholders will perceive project success and finally emotional competence can impact the project's and team satisfaction (Muller & Turner, 2012). Additionally, the program context that encompasses factors like organizational fit, program flexibility, organizational stability, resource availability and complexity can moderate the relationship between leadership competences and program success (Muller et al., 2012; Shao, 2018). In other words, different leadership qualities may need to be applied depending on the specific context.

Emotional intelligence is also considered a key factor in both leadership and project success (Fareed et al., 2022), aligning with 20 instances of the keyword *emotional intelligence* identified in the bibliometric analysis (see Table 1-2). The concept of emotional intelligence is examined through various lenses in the literature, including its positive impact on interpersonal relationships within project teams (Davis, 2011; Pryke et al., 2015). The study by Clarke (2010a) examines how emotional intelligence influences the project manager's ability to deal with conflict, collaborate within teams and serve as a transformational leader. Cultural understanding is also considered a key element of emotional intelligence, which is especially important for international projects that require a sensitivity to cultural differences (Dale & Dulaimi, 2016; Zhang & Fan, 2013). Ultimately, emotional intelligence is a necessary competence for navigating the complex relationships amongst individuals within projects.

Communication is also a critical project management competence associated with leadership skills and emotional intelligence. Communication spans a multitude of dimensions including internal communication within the project, external communication with various stakeholders, written and oral forms, formal and informal channels, and vertical and horizontal directions (Ruuska & Vartiainen, 2003). While communication is recognized as a critical success factor in project management, organizations often encounter challenges with information sharing (Blixt & Kirytopoulos, 2017; Ling & Ma, 2014).

Leadership, emotional intelligence, and communication are interconnected competences in the context of effective project management. Emotional intelligence is directly related to the ability to communicate given that effective communication requires the self-awareness to understand one's own emotions and the ability to also consider others' emotions (Luong et al., 2019). Leadership and communication are also directly related as project leaders need to be equipped with the appropriate communication tools and techniques to ensure effective information flow and avoid miscommunications amongst the project team (Ofori, 2014). Moreover, a leader's emotional intelligence contributes to fostering a positive working environment with an open exchange of ideas (Pryke et al., 2015).

In addition to leadership skills, emotional intelligence and communication, numerous studies in the existing body of literature are dedicated to further defining comprehensive lists of individual project manager competences. This includes Ahsan and Ho (2022) who compiled a list of 31 project manager competences based on an analysis of published job advertisements, including. Similarly, Chipulu et al. (2013) also examined online project management job advertisement, identifying a total of 68 keywords associated with competences that employers expect from project managers. In the context of smart building project management, Rodrigues et al. (2023) identified essential competences including technical competences, leadership, strategic management, communication, knowledge of budgeting and risk management, among others, forming part of a more extensive list. Today, digital intelligence is also among the latest competences identified as critical for project managers (Marnewick & Marnewick, 2021).

Some studies attempt to reduce the lists of competences by creating typologies that consider different factors such as types of projects, industry sectors and geographic locations. For

instance, Ahsan et al. (2013) examined 762 job advertisements to categorize the expected competences into 15 knowledge, skills and abilities (KSA) categories across different industries and countries. Vukomanovic et al. (2016) summarize version 4 of the IPMA Individual Competence Baseline (ICB), which reduces the previous list of 46 competences down to 29 competences. Yet, there are discrepancies between the competence requirements outlined in the IPMA ICB and those competences identified by project management experts as the most important (Soltysik et al., 2020). Finally, Miterev et al. (2016) identify unique program manager competences, which they argue are distinct from project manager competences, identifying subsets of competences based on program type.

#### 1.2.2.2 COLLECTIVE AND ORGANIZATIONAL COMPETENCE

The project management literature that analyzes competence at the project team and organizational levels is scarce compared to the literature on individual competences, Loufrani-Fedida and Saglietto (2016) introduce a framework that delineates three interconnected levels of competences in project management: individual, collective, and organizational. This multilevel approach to competences proposes that successful project management requires not only skilled individuals but also an alignment of competences at the group and organizational levels. Patanakul and Aronson (2012) focus on the relationship between organizational culture, project team culture, and project success. Their findings indicate that project team culture did not significantly contribute to project success. Lin et al. (2015) explore the collective knowledge of the project team and its role in problem solving to achieve project performance. Omorede et al. (2013) examine the relationship between project leader's competence, project team competence and project leader's obsessive passion. Medina and Medina (2014) investigate the organization's ability to develop long-term project management competences, emphasizing the importance of organizational-level competence development.

#### 1.2.2.3 SUMMARY

In summary, the literature on the types of competences can be broadly divided into two categories: 1. Individual project manager competences; and 2. Collective and organizational project management competences. The literature on individual project manager competences is large, aiming to define comprehensive lists of competences and create typologies to categorize competences based on factors like project type, industry, and geography. The literature on

collective and organizational project management competence attempts to go beyond the level of the individual project manager to examine the competence of the project team and the organization. However, these perspectives are limited and underexplored when compared to individual competence. The list of associated references from the bibliometric analysis can be found in Table 1-4 below.

| **Individual project manager competences** | | **Collective and organizational project management competences** |
|---|---|---|
| Luong et al. (2019)<br>Ofori (2014)<br>Pryke et al. (2015)<br>Liikamaa (2015)<br>Moyo and Chigara (2021)<br>Turner et al. (2010)<br>Muller et al. (2012)<br>Muller and Turner (2012)<br>Shao (2018)<br>Fareed et al. (2022)<br>Davis (2011)<br>Clarke (2010a)<br>Dale and Dulaimi (2016) | Zhang et al. (2013)<br>Ruuska and Vartiainen (2003)<br>Blixt and Kirytopoulos (2017)<br>Ling and Ma (2014)<br>Ahsan and Ho (2022)<br>Chipulu et al. (2013)<br>Rodrigues et al. (2023)<br>Marnewick and Marnewick (2021)<br>Ahsan et al. (2013)<br>Vukomanovic et al. (2016)<br>Soltysik et al. (2020)<br>Miterev et al. (2016) | Loufrani-Fedida and Saglietto (2016)<br>Patanakul and Aronson (2012)<br>Lin et al. (2015)<br>Omorede et al. (2013)<br>Medina and Medina (2014) |

Table 1-4: Theme 1 - Relevant references from bibliometric analysis

### 1.2.3 THEME 2: HOW PROJECT MANAGEMENT COMPETENCES ARE SHAPED

The second theme involves keywords that explain how project management competence is shaped such as *higher education, knowledge management, engineering education, training, learning, project-based learning, knowledge transfer, professional development, knowledge, competence management, experiential learning, active learning, competence development,* and *IPMA.* Crawford et al. (2006) suggest that there are two approaches to project management training: traditional and experiential learning. Traditional learning allows individuals to learn technical skills in a classroom-based environment by using the standards established by professional associations such as PMI, APM and IPMA (Egginton, 2012; Thomas & Mengel, 2008). Experiential learning, on the other hand, allows project managers to develop non-technical skills by actively engaging in professional activities that allow them to be a part of the social process (Crawford et al., 2006). Notably, there has been an increased research focus on experiential learning as the results of the bibliometric analysis in Table 1-2 show that 2019 was the average year of publication for this keyword. Thus, this section focuses on traditional and

experiential learning as both valid and complementary methods for acquiring project management competences.

#### 1.2.3.1 TRADITIONAL LEARNING

Traditional learning refers to the conventional approach for acquiring project management knowledge and skills through formal education and structured courses. It is often the starting point for individuals who wish to establish a basic understanding of project management principles and prepare themselves for a role in project management. Pursuing a formal degree offered by an academic or professional institution is a common path within traditional learning and the learning outcomes covers mainly technical skills in project management to plan, monitor, control, and execute the project (Nijhuis, 2017). For instance, project management undergraduate programs and courses taught at the university level offer similar curriculums throughout North America that include basic project management terminology, tools, and techniques. Likewise, professional institutions also provide corporate training programs to increase project management competences within their organizations (Alam et al., 2008; Buganza et al., 2013).

Moreover, professional associations play a critical role in defining competence frameworks that outline skills, knowledge and behaviours expected of competent project managers. While each framework has its own unique characteristics, they have all traditionally focused on technical skills as a core component of project management competences and have more recently started to incorporate non-technical skills as well. Examples of competence frameworks include the Project Manager Competency Development (PMCD) Framework published by PMI, the APM Competency Framework published by APM and the Individual Competence Baseline (ICB) for Project Management published by IPMA (APM, 2012; IPMA, 2015; PMI, 2017).

The skills acquired in academic institutions and professional associations are mainly assessed in the form of testing; leading to educational degrees and professional certifications (Nijhuis, 2017). These credentials serve as a form of validation, providing individuals with recognition and status within the field of project management (Morris et al., 2006; Nijhuis, 2017). Degrees and certifications may demonstrate credibility and establish a level of trust with employers (Blomquist et al., 2018), but they do not guarantee project success (Farashah et al., 2019; Morris et al., 2006). For instance, the findings of a study by Clarke (2010b) showed that a two-day

corporate training program focused on emotional intelligence was more effective after real-world application.

Despite possessing technical knowledge, several studies suggest that individuals who enter the project management profession are not fully prepared to lead projects. For instance, the accidental project manager stumbles upon the profession by accident and tends to possess technical knowledge while lacking skills to manage people and projects (Darrell et al., 2010). And those who intentionally enter the project management profession, specifically as new graduates, also struggle as they lack the work-life experience and leadership skills required to successfully manage projects (Hefley & Bottion, 2021). Similarly, Sharma et al. (2021) found that students with previous project management experience were better prepared to understand classroom teachings compared to a student without previous experience.

One reason for these challenges is that traditional learning is still predominantly focused on technical skills. Professional associations have published varying competence frameworks to establish what project managers need to know to deliver successful projects, however non-technical skills are underrepresented in these frameworks (Thomas & Mengel, 2008). This also influences learning curriculums in academic institutions and other training establishments that offer traditional project management education as they are largely based on the standards of professional associations (Thomas & Mengel, 2008). While traditional classroom-based learning is useful for building core skills, it does not accurately reflect the complexity of the real world (Egginton, 2012). Hefley and Bottion (2021) found that "there is a perceived gap between what educational institutions are offering and what is needed to deal with projects in the ever-increasingly complex work environment" (p. 67). There is a need for project management education and training programs to include not only technical skills but also soft skills, such as leadership, communication, and teamwork (Crawford & Pollack, 2004; Hefley & Bottion, 2021). Thus, it is important to supplement traditional project management learning with alternative approaches (Egginton, 2012).

#### 1.2.3.2 EXPERIENTIAL LEARNING

The importance of experience in developing competences for complex projects is widely recognized in the literature, especially within the MPC movement. While traditional learning,

such as textbook knowledge, formal education and professional certifications provide foundational knowledge, it is through real-world action and engagement with complexity that individuals truly enhance their abilities (Winter et al., 2006). Experience is critical in developing key competences such as confidence, intuition, judgement, ethical reflection and emotional intelligence (Cicmil, 2006; Cicmil et al., 2006). Real-world experience allows practitioners to encounter diverse situations, make sound and ethical decisions based on their judgement and intuition, and manage their emotions effectively in complex environments. The notion of the 'lived-experience' highlighted by Winter et al. (2006) refers to the practical knowledge gained through hands-on involvement in projects. This experiential learning enables individuals to grasp the complexity of projects in meaningful ways that cannot be fully captured in textbooks or project settings. Winter and Thomas (2004) argue that the complexity inherent in real life experiences provides a unique and valuable learning opportunity that cannot be replicated in controlled learning environments.

While learning can occur in all types of environments, structuring project environments that are conducive to learning can be a valuable approach in providing real-world quality learning opportunities to individuals (Sense, 2007). This can include workshops that focus on conversational learning, which may foster collective and individual reflection (Sense, 2005). In fact, collective reflection is also recognized as an effective approach to knowledge transfer in a project organization (Andersen & Hanstad, 2013). Additionally, educational curriculums that adopt different types of learning strategies more closely aligned with real-world scenarios should also improve project management education (Cordoba & Piki, 2012).

#### 1.2.3.3 SUMMARY

Traditional and experiential learning are distinct yet complementary and necessary methods for acquiring project management competences. Traditional learning takes place in controlled environments such as academic institutions and professional institutions where the acquired knowledge is validated by certificates and professional accreditations. Competence is validated by credentials such as educational degrees and professional certifications. On the other hand, experiential learning takes place over time through hands-on practical interactions with projects and continuous reflection to acquire non-technical skills such as confidence, intuition, judgement, ethical reflection, and emotional intelligence. This knowledge is validated through action and performance and provides the ability for interpretation and sound judgement in context-

dependent situations. Competence is validated by real-world performance, with consideration of intellectual and ethical dimensions. The list of associated references from the bibliometric analysis can be found in Table 1-5: below.

| Traditional Learning | Experiential Learning |
|---|---|
| Alam et al. (2008)<br>Buganza et al. (2013)<br>Morris et al. (2006)<br>Blomquist et al. (2018)<br>Clarke (2010b)<br>Farashah et al. (2019)<br>Sharma et al. (2021) | Crawford et al. (2006)<br>Sense (2007)<br>Sense (2005)<br>Cordoba and Piki (2012)<br>Andersen and Hanstad (2013) |

Table 1-5: Theme 2 - Relevant references from bibliometric analysis

## 1.3 PROBLEM DEFINITION

The bibliometric analysis informed a literature review structured around two emerging themes: 1. Types of competences; and 2. How competences are shaped. This review reveals the lack of a comprehensive framework for understanding project management competences. In exploring the first theme, the literature primarily emphasizes individual project manager competences, with a smaller body of work addressing collective and organizational-level competences.

The studies that focus on identifying individual project manager competences have generated exhaustive lists of technical and non-technical skills in the literature. The extensive list of competences that a project manager is expected to learn continues to increase and establishes an unrealistic expectation of the project manager who is often perceived as shouldering the entire responsibility for a project's success or failure (Loufrani-Fedida & Missonier, 2015). This contributes to a false image of the project manager who is seen as a 'hero' (Loufrani-Fedida & Missonier, 2015) or 'magician manager' (Napier et al., 2009), which is detrimental to the organization; generating tensions and a lack of collaboration among team members (Tourish, 2019). This has resulted in studies that focus mainly on the competence of the individual project manager, which is not effective in overcoming these unrealistic expectations.

Similarly, the research explored under the umbrella of the second theme delves into the development of project management competences and identifies a fragmented and narrow focus

on individual competences. The literature predominantly focuses on developing the competence of the individual project manager, ignoring the broader community of practitioners and the levels of competence beyond the individual.

In fact, the findings of the bibliometric analysis in Table 1-2 confirm the predominant focus of project management competence on the individual level, specifically the project manager. The keyword *project manager* appears 53 times compared to the keyword *project team* which appears only 3 times. This emphasis on the project manager as a primary subject of study reflects a significant gap in the literature as it may be limiting our understanding of the complexities involved amongst the multiple levels of competences in project management and how they are connected.

The call from researchers to include various levels of analysis in project studies, from individual to societal (Geraldi & Soderlund, 2018; Loufrani-Fedida & Missonier, 2015), holds promise for constructing a more comprehensive framework of project management competence. While research in this area is limited, the concept of multilevel analysis may provide a broader and more nuanced perspective that considers the interconnections of competence at various levels, such as those proposed by Loufrani-Fedida and Missonier (2015) which include the individual, collective and organizational levels. Moreover, research suggests that collective competence is critical to achieve project success (Ruuska & Teigland, 2009; Ruuska & Vartiainen, 2003).

The departure from an exclusive focus on individual competence may provide a more accurate representation of the complex dynamics within project teams, organizations and industries. This broader understanding may shed light on how competence is shaped at all levels and how it influences project success.

Accordingly, the main objective of this research is to understand how project management competence is shaped using a multilevel approach that goes beyond individual competence. This includes understanding how competence is connected across the individual, collective and organizational levels and how much those connections help shape each other, as shown in Figure 1-3 below.

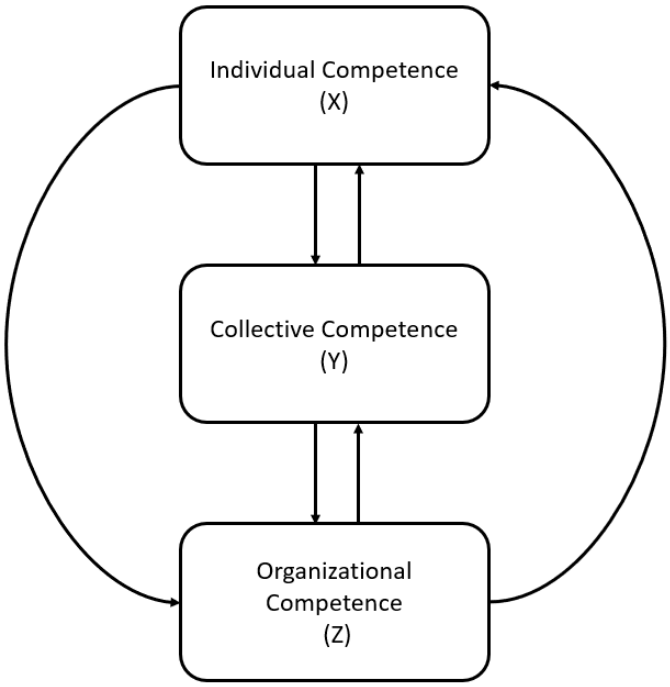



Figure 1-3: A multilevel approach to understanding how project management competences are shaped

## 1.4 SITUATING THE STUDY WITHIN THE BROADER RESEARCH FIELDS

This study is situated within the broader research fields of temporary organizations, competences and process studies as depicted in Figure 1-4 below. This study draws upon theories and insights from these fields to address the proposed research question centered around competence. The following sub-sections describe how each of these fields may be useful for enlightening this research.

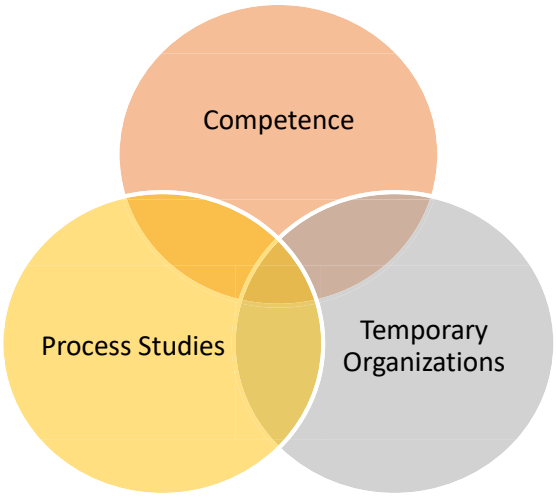



Figure 1-4: Where the proposed research fits within the broader research fields

### 1.4.1 PROCESS STUDIES

First, this research leverages concepts from process studies such as temporality, to consider the dynamic nature of competences and how they develop and change over time within the context of ongoing interactions (Brunet et al., 2021). This is especially relevant when using a multilevel analysis approach because "ongoing interactions among different individuals, between individuals and organizations, and between multiple levels across organizations and contexts permeate and orient change processes" (Langley et al., 2013, p. 9). For instance, organizational competence may evolve because of continuous interactions between individuals and the organization, and across different hierarchical levels. These interactions can be influenced by various factors such as changes in leadership that bring new strategic vision to the organization or culture evolution within the organization that impact how teams and individuals collaborate. Ultimately, drawing from insights in process studies helps to understand how and why competences change over time and to view competence as a continuous process rather than simply a fixed variable.

### 1.4.2 TEMPORARY ORGANIZATIONS

This research draws on theories and research on temporary organizations. The focus is on project-based organizations, a distinct type of organization that operates through projects that is characterized by a temporary and goal-oriented structure. Drawing from insights on how project organizations behave, especially in a time-limited context that brings together a group of people

that may be collaborating for the first time (Soderlund, 2004), provides useful context in understanding how competences develop and evolve across multiple levels within this unique setting.

### 1.4.3 COMPETENCE

Examining the broader literature on competence is important to delineate what is meant by competence at the individual, collective, and organizational levels. As well, it sheds light on what is currently known about the connections and relationships across these levels. Reviewing multilevel studies of competences is particularly useful for understanding the relationship between competence at the individual, collective, and organizational levels (Geraldi & Soderlund, 2018). Subsequently, this helps formulate hypotheses and develop a conceptual framework for this study.

## 1.5 RESEARCH OBJECTIVES AND RESEARCH QUESTIONS

The main objective of this research is to understand how project management competence is shaped using a multilevel approach that goes beyond individual competence. This includes understanding how they are connected and how much those connections help shape each other as shown in Figure 1-3. Accordingly, the main research question is defined as follows:

**How is project management competence shaped from a multilevel perspective?**

Drawing from this main research question, specific research objectives and specific research questions have also been formulated and are summarized in Table 1-6.

| Specific Research Objectives | Specific Research Questions | Comments |
|---|---|---|
| Define the following three factors:<br><br>X: Individual competence<br>Y: Collective competence<br>Z: Organizational competence | | These objectives are addressed in the literature review in section 2.2, 2.3, and 2.4 respectively |
| Understand the relationship between individual competence (X) and collective competence (Y) | RQ1: What is the nature of the influence between individual competence (X) and collective competence (Y)? | Working abductive hypotheses are formulated for these research questions at the end of the literature review in Section 2.5 |
| Understand the relationship between collective competence (Y) and organizational competence (Z) | RQ2: What is the nature of the influence between collective competence (Y) and organizational competence (Z)? | |
| Understand the relationship between individual competence (X) and organizational competence (Z) | RQ3: What is the nature of the influence between individual competence (X) and organizational competence (Z)? | |

Table 1-6: Proposed research objectives and research questions

## 1.6 EXPECTED CONTRIBUTION TO THEORY AND PRACTICE

Like most management studies, multilevel analysis has not been extensively applied in project management research, nor competence research, despite its potential to provide a more comprehensive understanding of project studies (Tywoniak et al., 2021). According to Soderlund et al. (2008), "mainstream analyses of project competence tend to neglect the interrelatedness of the competence developed at the project-level and the competence developed at the organizational level" (p. 518). Given the limited number of multilevel studies in the field of project management, particularly those centred on competences, this study promises to offer a richer and more comprehensive understanding of how competences interact across multiple levels. It serves to enrich the academic discourse on multilevel analysis and helps to bridge the micro-macro gap in project studies (Klein et al., 1999; Molina-Azorin et al., 2020).

From a practical perspective, this study has the potential to address the misconception that individual project managers are entirely responsible for project success. Shedding light on the relationship between competences across multiple levels may help to remove this unrealistic expectation placed on the project manager and recognize that project success depends just as much on the team and the organization.

## 1.7 SUMMARY

A review of the literature on project management competence has revealed an overwhelming emphasis on individual competence, disproportionately attributing project success to the competence of the individual project manager. This narrow focus places significant pressure on the project manager while overlooking the impact of collective and organizational competence. This study seeks to propose a more comprehensive framework for understanding competence, which includes individual, collective, and organizational competence.

Specifically, the scope of this research encompasses the three levels of competence (individual, collective and organizational) and their interdependent relationships. This study seeks to quantify the nature of the influence between competences at different levels. In other words, understanding how much competence at one level influences competence at another level. It is important to note that the scope of this research does not include any external factors that may also influence these various levels of competence. Moreover, this research does not directly explore the relationship between competence and project success given that this is an underlying assumption.

# CHAPTER 2 : LITERATURE REVIEW

Chapter 2 establishes the theoretical framework, which serves as a foundation to carry out a comprehensive review of the existing literature focused on defining the three main factors involved in this study: individual, collective, and organizational competences. Building on this foundation, the chapter proceeds to explore what is already known about the nature of the relationships between the variables to formulate abductive working hypotheses and propose a conceptual framework.

Section 2.1 explains the pragmatic philosophical framework that serves as a basis for this research, which includes assumptions about a becoming ontology and a process studies epistemology. Within this framework, the theory on temporary organizations becomes useful for understanding competences. Section 2.2, 2.3, and 2.4 define the notion of individual competence, collective competence, and organizational competence respectively. This involves a review of the theoretical background for each concept and an examination of relevant frameworks within the literature and professional communities. Lastly, Section 2.5 explores the relationships between the levels of competence according to the specific research questions. Insights drawn from existing studies are used to formulate abductive working hypotheses and propose a conceptual framework. The framework serves as the foundation for this research and guides the empirical investigation that follows.

## 2.1 THEORETICAL FRAMEWORK

Establishing the theoretical framework is a critical step before carrying out any type of research as it is used to guide the remainder of the research journey. The theoretical framework identifies how the researcher understands the world in terms of what is knowable and the means through which knowledge can be acquired (Gauthier, 2014; Saunders et al., 2019). Consequently, it influences and informs both the overarching methodology and specific research methods for conducting the study. Within this philosophical introspection, the researcher identifies fundamental elements that resonate true for them. Beginning with the formulation of a research philosophy, the researcher proceeds to identify their ontological lens, epistemological perspective,

and theoretical background. Essentially, each of these elements serves as a building block upon which subsequent research decisions can be made (Gauthier, 2014).

### 2.1.1 RESEARCH PHILOSOPHY

This study is grounded in a pragmatic research philosophy. The origins of pragmatism are attributed to Pierce, James, Dewey, and other intellects of the late 19th century (Kelly & Cordeiro, 2020; Lorino, 2018; Simpson & den Hond, 2022). This was an era marked with significant historical events such as the recent introduction of Darwin's theory of evolution, the end of the Civil War and the evolving American lifestyle (Lorino, 2018). These events prompted academics like Pierce, James, and Dewey to challenge the positivist scientific practices that were popular at the time in favor of an approach emphasizing the importance of experiential knowledge in shaping human understanding (Kelly & Cordeiro, 2020; Lorino, 2018). Pragmatism has since evolved over the years, and its relevance has expanded to many disciplines, including organizational studies.

Building upon the foundations of classic pragmatism, Farjoun et al. (2015) identify four interrelated principles of pragmatism: processes, relationships, recursiveness, and antidualism. These four principles are highly useful for understanding competence in the context of this study. Hence, the following paragraphs briefly summarize the four principles and how they apply to the understanding of competence.

First, pragmatism focuses on processes to understand the world, which are characterized by temporality, dynamic change, serendipity, and adaptation (Farjoun et al., 2015). Moreover, pragmatism acknowledges the presence of stable structures to support these processes. From this perspective, stability and change can coexist, allowing for both routine structures and innovation within an organization (Farjoun et al., 2015). Similarly, this view is useful for reconciling the stable and dynamic nature of competence.

Second, pragmatism focuses on exploring relationships, which is believed to provide a more comprehensive understanding of social entities and concepts than simply their characteristics. In fact, the characteristics of entities are the result of their relationships with other entities (Farjoun et al., 2015). These relationships are also viewed as processes, as they can change over time. This perspective aligns well in the context of understanding how individual, collective,

and organizational competences are shaped as the emphasis is on the relationship between these entities.

Third, recursiveness is the process where actions can be revisited and continuously adjusted based on new facts. Failure to adapt continuously may lead to abrupt and disruptive changes (Uhl-Bien & Arena, 2017). Moreover, central to the pragmatic perspective is the triadic model of human nature, which establishes a recursive relationship between habits, emotions, and deliberation (Farjoun et al., 2015). Throughout cycles of reflection and inquiry, individuals, organizations and societies continuously adapt and evolve (Miettinen et al., 2012). As articulated by Kelly and Cordeiro (2020), "interpreting knowledge and beliefs leads to action and reflecting on actions leads to new ways of knowing and acting" (p. 2). This perspective aligns well with multilevel research endeavors such as this one as recursive logic facilitates the examination of how phenomena at one level can impact phenomena at other levels of analysis (Farjoun et al., 2015).

Finally, pragmatism embraces antidualism, where things that are normally considered to be opposing and conflicting can be complementary and coexist. In the words of Simpson and den Hond (2022), "they are aspects of the same rather than opposites" (p. 132). For example, an organization can exhibit both order and flexibility simultaneously, as illustrated by Uhl-Bien and Arena's (2017) model of the adaptive space which bridges the operational system that is concerned with orders, rules, and regulations, and the entrepreneurial system that focuses on innovation. Moreover, dichotomies such as theory and practice can be challenged by viewing them instead as interconnected social processes that mutually influence each other. A pragmatist view can also help to reconcile the means-ends dichotomy, where ends are not necessarily separate outcomes but rather the means to achieving broader objectives (Lorino, 2018).

### 2.1.2 ONTOLOGICAL LENS

According to Saunders et al. (2019), "ontology refers to assumptions about the nature of reality" (p. 133). Consistent with the pragmatist view of the world, a becoming ontology is useful in the context of this research as it aligns with the evolving nature of learning and change (Tsoukas & Chia, 2002). As opposed to a being ontology that views project entities as stable and static objects within the umbrella of project management, a becoming ontology focuses on evolution, co-construction and emergence (Linehan & Kavanagh, 2006). Specifically, this research views

competence as continually evolving and adapting as it is shaped and continually redefined through ongoing interactions and experiences.

### 2.1.3 EPISTEMOLOGICAL PERSPECTIVE

This research adopts a process-based epistemology, which focuses on understanding the emergence, development, growth or termination of phenomena over time (Langley et al., 2013). According to Soderlund et al. (2008), a process approach involves acquiring knowledge from the interaction of various entities:

> "We therefore assume a fundamental interconnectedness of all things, and that entities that are connected mutually define one another and make one another significant" (p. 519).

This assumption is consistent with the pragmatist view of the world and a becoming ontology (Farjoun et al., 2015; Langley et al., 2013). Moreover, it offers a comprehensive lens through which to understand the dynamic relationships between the multiple levels of competence as processes play a key role in project management (Brunet et al., 2021). The development of competence can also be understood as dynamic process that is defined locally and changes over time (Soderlund et al., 2008).

The following section examines a theory derived from process studies, which is specifically focused on temporary organizations. Temporary organizations are specific instances of organizational structures that can be studied as unique cases within the broader field of process studies because of their temporal nature (Brunet et al., 2021). Specifically, projects are recognized as temporary organizations where resources are allocated for a "specific, unique, novel and transient endeavor" (Turner & Muller, 2003, p. 7). Temporary organizations are distinct from more traditional, permanent structures because they are time-bound, and goal oriented in nature (Brunet et al., 2021; Lundin & Soderholm, 1995). This theory sheds light on the unique context in which project management competence is shaped.

### 2.1.4 THEORETICAL BACKGROUND

Although classic organizational theories may offer some insights into understanding temporary organizations, a deeper understanding of how competence manifest in projects requires the examination of specific theories tailored to temporary organizations (Kenis et al., 2009). While

the theoretical foundations of temporary organizations are scarce and are not well developed (Kenis et al., 2009; Soderlund, 2004; Soderlund et al., 2008), Lundin and Soderholm (1995) lay the groundwork for a theory on temporary organizations that is guided by action and grounded in the four basic concepts of task, time, team, and transition.

Lundin and Soderholm (1995) identify action as the primary concept behind temporary organizations, which is supported by the four underlying concepts of task, time, team, and transition. First, time is considered a limited resource that influences the urgency of actions, differentiating temporary organizations from permanent organizations, which are not time-bound and are focused on long-term survival. Second, actions within temporary organizations are task-based, necessitating specific resource allocation in the form of finances and materiel. In contrast, permanent organizations tend to be more goal oriented, where goals are reviewed on a regular basis. Third, temporary teams are formed around specific tasks and for the duration of the allocated time while permanent organizations establish a working organization that is a more enduring structure. Team members may be selected based on how the task is defined. If the team is organized before the task has been fully defined, then team members and their competences influence what task or transition aspirations may be proposed" (Lundin & Soderholm, 1995, p. 450). Lastly, guided by the focus on action, there is an expectation that a transition takes place resulting in internal and/or external change to the temporary organization. Permanent organizations, dedicated towards long-term survival, focus on continual development. The tensions that arise from the coexistence of temporary and permanent structures are summarized in Table 2-1 below. Given that project-based organisations inherently operate through a series of recurring temporary projects within a permanent organizational structure, it is important to find ways to reconcile these tensions (Bredin, 2008).

| Temporary Organization / Project | | Permanent Organization |
|---|---|---|
| time | vs | survival |
| tasks | vs | goals |
| team | vs | working organization |
| transition | vs | continual development |

Table 2-1: Characteristics of permanent and temporary organizations from Lundin and Soderholm (1995)

These distinct characteristics of temporary organizations present unique challenges and considerations for competence development. Teams in temporary organizations are assembled to achieve specific objectives within a predetermined timeframe, introducing a context where individuals may collaborate briefly and then disperse. Temporary organizations, especially project groups within firms, consist of individuals who often have not met before. The need for effective collaboration is crucial as the team is tasked with carrying out a pre-specified task within set limits of time and costs (Lindkvist, 2005). Moreover, the selection of members is typically based on interpersonal skills and competences rather than professional qualifications, highlighting the importance of collaboration within a temporary team (Janowicz-Panjaitan et al., 2009). When a project concludes, "members of the disbanded team often have little time or motivation to reflect on their experience and document transferable knowledge for recycling in future projects" (Brady & Davies, 2004, p. 1601). Essentially, the unique characteristics and team dynamics of temporary organizations influence how competence is shaped in project-based organizations.

The basic concepts and their connections are depicted on the left-hand side of **Error! Reference source not found.** below, with time being the central concept as it acts as a constraint for the other three concepts. The right-hand side of **Error! Reference source not found.** depicts the sequencing concept which breaks down the temporary organization into four overlapping phases to understand how action is carried out: action-based entrepreneurialism, fragmentation for commitment-building, planned isolation, and

Vestola et al. (2021) build on the theory of temporary organizations proposed by Lundin and Soderholm (1995) by recognizing that the boundaries between the temporary and permanent

aspects coexist internally within project organizations. Vestola et al. (2021) applied the basic concepts of time, tasks, team and transition to analyze public infrastructure operation and maintenance (O&M) projects. The results of their study revealed a mixture of temporary and permanent aspects within the projects. Essentially, the relationship between permanent and temporary not only exists between the temporary organization and the permanent environment, but also within the project itself. Moreover, the introduction of permanent aspects into the four basic concepts of time, tasks, team and transition revealed significant interdependencies. Finally, Vestola et al. (2021) demonstrate that O&M projects fall outside the typical model proposed by Lundin and Soderholm (1995), where "something has to be transformed or changed as a consequence of the existence of the temporary organization" (p. 442). O&M projects are temporary in terms of contracts but permanent in terms of facility, task, and team continuity. This leads to a focus on continual development rather than traditional project transition.

Overall, a process approach, and more specifically the temporary organization structure, serves as a valuable perspective for understanding the dynamic process of competence development. One key insight derived from this perspective is the notion that competence is not necessarily a static entity but may evolve and take shape over time. For instance, practitioner competence is in constant state of transformation as individuals carry out projects and progress along their career. This transformation process occurs progressively over time because of various interactions that the practitioner has with projects, the project team, the organization, and other entities. The theoretical framework by Lundin and Soderholm (1995) further enriches this understanding by dividing the temporal dimension of a project into four distinct action-based phases. Each phase represents a unique stage in the project's lifecycle, offering distinct points in time where competence has the potential to evolve. Vestola et al. (2021) further broaden this framework by also focusing on the permanent aspects of certain types of project organization. For instance, the permanence of teams in O&M projects allows project managers more flexibility in capturing knowledge and sharing it at the higher organizational level.

### 2.1.5 LEVEL AND UNIT OF ANALYSIS

One of the critical steps in multilevel research is to identify the level of analysis, also known as the focal unit, so that levels of theory and analysis are well aligned (Hitt et al., 2007). Level of analysis refers to "the unit to which data are assigned for hypothesis testing and statistical analysis"

(Rousseau, 1985, p. 4). Defining this upfront also provides specificity that facilitates theory building and testing (Klein et al., 1999). According to Hitt et al. (2007), "focal units are entities about which one wishes to make generalizations" (p. 1388). "In other words, it is the level at which a particular construct of effect is predicted to exist" (Molina-Azorin et al., 2020, p. 325). For instance, focal units may include individuals within an organization or various collectives such as project teams, communities of practice, strategic alliances, and many others.

Many studies have focused on individual competence from a single level of analysis as discussed in Section 2.1.1, while other multilevel research has focused on the PBO at the organizational level as the focal unit (see Loufrani-Fedida and Missonier (2015)). However, this study seeks to depart from this conventional approach by adopting a more nuanced perspective.

The aim is to collect data from three distinct focal units, each residing within one of three levels of analysis. This methodology offers a fresh lens through which to examine competences, by investigating how much an entity from one level of analysis influences the competence of an entity within another level. For instance, it may shed light on how much an individual team member shapes the collective competence of the project team, and how much the project team shapes the competence of the broader project organization.

In the process of gathering and evaluating data at the collective and organizational levels, it is important to adopt an approach that involves gathering individual-level data but with a specific focus on collective and organizational phenomena as described below:

> "When operationalizing collective constructs, researchers may justifiably collect individual-level data. To collect data that are meaningful at the collective level, however, one must have a conceptual rationale for the level of measurement chosen. Inferences at the collective level will be facilitated by focusing on collective phenomena, framing questions in collective terms, treating individuals as informants about collective processes, and focusing on the role of individuals in terms of the wider collective" (Morgeson & Hofmann, 1999, p. 261).

Ultimately, the researcher collects data from individual people. However, when collecting data regarding collective and organizational competence, the questions need to be focused on collective and organizational phenomena.

The unit of analysis, also known as the level of measurement, refers to "the unit to which the data are directly attached" (Rousseau, 1985, p. 4). In the context of this study, the focus is on competence, and as such is the primary unit of analysis.

### 2.1.6 SUMMARY

Table 2-2 below summarizes the theoretical framework underlying this research, which adopts a pragmatist research philosophy and the assumptions of a becoming ontology and a process approach to acquiring knowledge. The primary theory mobilized in this framework is the temporary organization. Moreover, to understand the relationships between the various levels of competence, this research examines three levels of analysis: individual competence assessed at the individual level, team competence assessed at the project team level and organizational competence assessed at the organizational level. These measurements shed light on how much an entity at one level shapes the competence of an entity at another level. The primary unit of analysis for this framework is competence.

| Section | Theoretical Framework | | References |
|---|---|---|---|
| 2.1.1 | Research Philosophy | Pragmatism | Farjoun et al. (2015), Lorino (2018) |
| 2.1.2 | Ontological Perspective | Becoming | Tsoukas and Chia (2002), Linehan and Kavanagh (2006) |
| 2.1.3 | Epistemological Perspective | Process View | Langley et al. (2013), Brunet et al. (2021) |
| 2.1.4 | Theories Mobilized | Temporary Organization | Lundin and Soderholm (1995), Vestola et al. (2021) |
| 2.1.5 | Level of Analysis | Individual, collective and organizational | |
| 2.1.5 | Unit of Analysis | Competence | |

Table 2-2: Theoretical Framework

## 2.2 INDIVIDUAL COMPETENCE (X)

This section begins by exploring the various definitions of individual competence as presented in the academic literature as well as the professional bodies of knowledge. It also examines the theoretical foundations that inform these definitions. Following this review, the section presents an overview of established frameworks used to measure individual competence, with the aim of identifying the most relevant dimensions for the current study.

### 2.2.1 DEFINITION AND THEORETICAL BACKGROUND

Individual competence has been defined and interpreted in various ways throughout the years by both researchers and professional bodies of knowledge. Unfortunately, the multitude of definitions and the lack of a shared understanding of the term competence has made it difficult to understand what a competent project manager looks like. Moreover, adding to the confusion is that the terms competence and competency are often used interchangeably in the literature (Khan & Ramachandran, 2012). Without a mutual understanding of the term competence, it is unclear

whether these frameworks are referring to the same thing at all. Robotham and Richard (1996) explain this problematic well:

> "Given the lack of a clear and universally agreed definition of to what competence refers to, are such measures valid? For while it may be true that these approaches are indeed measuring something, it is not clear whether the something being measured in each case is competence" (p. 25).

As such, it is important to examine the notion of competence found in both the literature and professional bodies of knowledge. Understanding the theoretical foundation and establishing a comprehensive definition of competence for this research endeavor ensures a coherent understanding of the construct.

First, it is important to discern between the terminology used in the literature to establish the correct language for this research. The term competency refers to specific skills or capabilities required within a given context (Khan & Ramachandran, 2012). In contrast, competence denotes not only the possession of a skill but the broader capacity and proficiency to effectively execute that skill (Khan & Ramachandran, 2012). Khan and Ramachandran (2012) delineate the two terms using a medical example:

> "For instance, the skill of insertion of a nasogastric tube is the 'competency' while the person able to perform this has the 'competence' to do this. So an assessment tool designed to test the ability to insert the nasogastric tube is a competency-based assessment tool, which assesses the competence of the person performing it" (p. 3).

Bandura's social cognitive theory and Vygotsky's sociocultural theory provide insights into the performance-aspect of competence as they draw on the cognitive process involved in competence development. Bandura's social cognitive theory explains human behaviour using a triadic reciprocal causation model where behaviour, cognitive and other personal factors and environmental events continuously interact and influence each other (Wood & Bandura, 1989). In this relationship, individuals both shape and are shaped by their environments. Wood and Bandura (1989) outline several mechanisms that can be leveraged to develop individual competence

including observational learning and guided practice, self-regulatory mechanisms that enhance self-efficacy beliefs, and establishing goal systems to give individuals direction.

Similarly, Vygotsky's sociocultural theory explains human learning through the process of social interaction. In the early twentieth century, the field of psychology viewed internal and external learning as mutually exclusive processes. Vygotsky challenged this dichotomous perspective on learning, proposing instead that competence emerges from a dynamic relationship between social interactions and individual cognitive processes (John-Steiner & Mahn, 1996). Ultimately, both the social cognitive and sociocultural theories highlight the recursive relationships between the cognitive process and other elements to understand competence development.

Likewise, in the context of project management, Crawford (2005) includes proficiency and the cognitive process in their understanding of project manager competence. The author combines attribute-based competences, which encompasses knowledge, skills, attitudes, and behaviours, with performance-based competences involving the demonstrable performance of the individual in accordance with recognized standards to define competence. Figure 2-1 below illustrates the breakdown of the competence construct into the attribute-based and performance-based competence. By recognizing the relationship between individual attributes and demonstrated performance, Crawford (2005) provides a comprehensive understanding of competence that involves both the cognitive elements and observable behaviours.

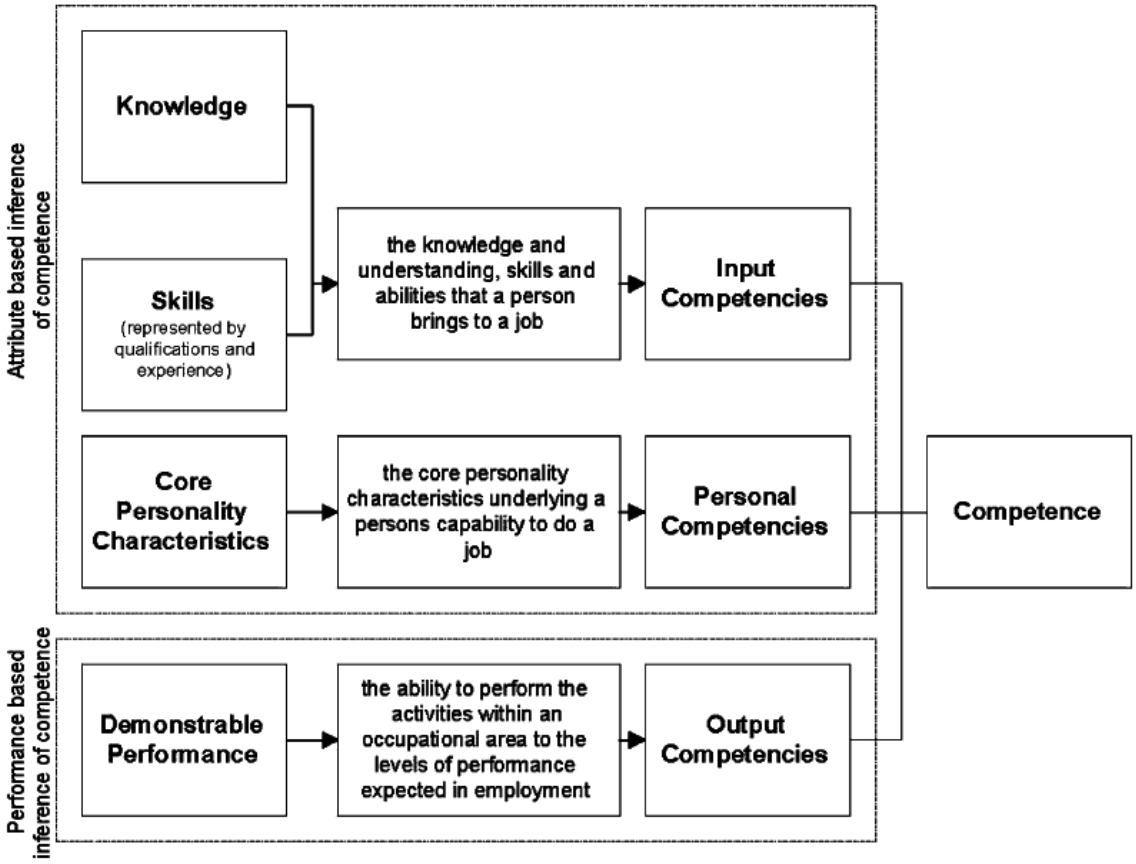



Figure 2-1: Components of the overall competence construct (Crawford, 2005, p. 9)

Professional associations have also contributed to the discourse on competence by publishing their own unique definitions of competence in their professional bodies of knowledge. Table 2-3: compares the definitions of competence set out by international organizations such as the PMI, APM, IPMA and ICCPM. Despite the nuances in their definitions, they all align with Crawford's (2005) notion of competence, focusing on what an individual knows (attribute-based competence) and their demonstrated performance (performance-based competence).

| | Definition of Competence | Reference |
|---|---|---|
| PMI | Ability to perform activities within a portfolio, program, or project environment that lead to expected outcomes based on defined and accepted standards. | PMI (2017, p. 1) |
| APM | The combined knowledge, skill and behaviour that a person needs to perform properly in a job or work role. | APM (2012, p. 6) |
| IPMA | The application of knowledge, skills and abilities in order to achieve the desired results. | IPMA (2015a, p. 15) |
| ICCPM | The project management paradigm (mindset), behaviours and knowledge as well as the special attributes required to operate effectively within the complex project environment. | ICCPM (2012, p. 2) |

Table 2-3: Various definitions of competence published by PMI, APM, IPMA, and ICCPM

### 2.2.2 INDIVIDUAL COMPETENCE FRAMEWORKS

In the extensive body of literature, academics have proposed countless ways of categorizing individual competence. El-Sabaa (2001) presents a framework that includes three observable categories of competence: 1. Human skills, which focuses on the ability to work with people; 2. Conceptual and organizational skills to understand the project as a whole; and 3. Technical skills to apply tools and techniques from the specific discipline. Le Deist and Winterton (2007) define a typology of competence comprised of four dimensions including cognitive competence (problem-solving approach), functional competence (job-related standards), social competence (interaction with others) and meta competence (learning how to learn). Cheng et al. (2005) focuses on generic competences that are applicable across diverse projects as well as industry-specific job-task competences. Stevenson and Starkweather (2010) identify six critical core competences for project managers that include leadership, communication, verbal and written skills, attitude, and the ability to deal with change. A study in the defence sector by Bolzan de Rezende et al. (2021) reveal ten groups of competences required to manage complex projects: influencing, communication, team working, cognitive, management, contextual skills, professionalism, project management knowledge, and personal skills and attributes.

From a practical standpoint, professional associations such as PMI and IPMA, have published distinct competence frameworks that are widely employed today. The PMI Project

Manager Competency Development Framework encompasses up to 19 individual competences. These competences are divided into two main categories: performance competences refer to what can be accomplished with project management knowledge and skills and personal competence encompass behaviours, attitudes and other core personality characteristics (PMI, 2017). The framework uses a numerical rating scale from one to five to assess the level of competence and primarily targets project, programme, and portfolio managers. Table 2-4 summarizes the 16 competences associated with the project manager.

| **Performance Competences** | **Personal Competences** |
|---|---|
| Project Integration Management | Communicating |
| Project Scope Management | Leading |
| Project Time Management | Managing |
| Project Cost Management | Cognitive ability |
| Project Quality Management | Effectiveness |
| Project Human Resource Management | Professionalism |
| Project Communications Management | |
| Project Risk Management | |
| Project Procurement Management | |
| Project Stakeholder Management | |

Table 2-4: PMI Project Manager Competency Development Framework for a Project Manager (PMI, 2017)

PMI has also introduced a revised version of its PMI Talent Triangle to guide practitioners in their ongoing competence development efforts. According to PMI (2024), this updated framework identifies three key areas for continuous improvement: Ways of working (formerly technical project management), Power Skills (formerly Leadership) and Business Acumen (formerly Strategic and Business Management). Ways of working addresses proficiency in various approaches and methodologies such as agile and design thinking. Power skills encompass a spectrum of skills including collaborative leadership, communication, and empathy, among others. Business acumen involves understanding the dynamics within the organization and the industry at large to foster effective decision-making capabilities.

Similar to the PMI Talent Triangle, the IPMA Individual Competence Baseline (ICB) (IPMA, 2015) divides 28 competences into three areas known as the Eye of Competence: 1. People competences are the personal and interpersonal abilities of an individual; 2. Practice competences focus on the application of traditional tools and techniques; and 3. Perspective competences deal

with the understanding of external drivers such as organizational strategy (IPMA, 2015). Table 2-5 shows how these competences are divided. IPMA uses different measurements for key competence indicator (KCI) that indicate project, programme and/or portfolio success in each competence area. IPMA also focuses on the project, programme, and portfolio manager.

| People | Practice | Perspective |
|---|---|---|
| Self-reflection and self-management | Project design | Strategy |
| Personal communication | Requirements and ojectives | Governance, structures and processes |
| Personal integrity and reliability | Scope | Compliance, standards and regulations |
| Relationships and engagement | Time | Power and interest |
| Leadership | Organization and information | Culture and values |
| Teamwork | Quality | |
| Conflict and crisis | Finance | |
| Resourcefulness | Resources | |
| Negotiation | Procurement | |
| Results orientation | Plan and control | |
| | Risk and opportunity | |
| | Stakeholders | |
| | Change and transformation | |

Table 2-5: IPMA Individual Competence Baseline for Project, Programme, Portfolio Manager (IPMA, 2015)

Among the various professional bodies of knowledge, IPMA presents a compelling framework for this study as they recognize how individual competence is influenced by team and organizational competence:

> "The interactions between individual, collective and organisational competence development offer different approaches to the development of individual competence" (IPMA, 2015).

While IPMA does not provide any in depth description of these interactions, this recognition sets IPMA apart from other competence frameworks that do not address the multiple levels of competence or their interconnectedness. IPMA also offers both individual and organizational competence frameworks, which help to facilitate the identification of baseline competences at both levels to study their relationships.

Given the constraints of resource and time, when delineating the parameters of this study, it is necessary to narrow the focus to a limited set of competences. As such, this study examines

three competences within the People category: Teamwork, Personal Communication, and Relationships and Engagements. The deliberate selection of these three competences stems from their critical role in fostering collaborative efforts within any organizational setting. As such, these competences align with similar types of competences to be studied at the collective and organizational levels. The IPMA ICB (IPMA, 2015) decomposes these three competences into smaller components, which form the basis for this construct and are used for data collection and analysis.

### 2.2.3 SUMMARY

Table 2-6 presents the relevant dimensions of individual competence for this study, including a summary of both its definition and theoretical underpinnings. Moreover, at the individual level, this research adopts the IPMA Individual Competence Baseline as the framework for individual competence assessment. Notably, the study centers on three measurable dimensions of individual competence outlined within the IPMA Individual Competence Baseline: Teamwork, Personal Communication, and Relationships and Engagements.

| **Individual Competence (X)** | | **Reference(s)** |
|---|---|---|
| Definition | Not only the possession of a skill but the broader capacity and proficiency to effectively execute that skill. | Khan and Ramachandran (2012) |
| Theoretical Background | Bandura's Social Cognitive Theory | Wood and Bandura (1989) |
| | Vygotsky's Sociocultural Theory | John-Steiner and Mahn (1996) |
| Competence Framework | IPMA Individual Competence Baseline | IPMA (2015b) |
| Measurable dimensions of individual competence | o Teamwork (TW)<br>o Personal Communication (PC)<br>o Relationships and engagement (RE) | |

Table 2-6: Summary of Individual Competence

## 2.3 COLLECTIVE COMPETENCE (Y)

This section begins by exploring the various definitions of collective competence as presented in the academic literature as well as the professional bodies of knowledge. It also examines the theoretical foundations that inform these definitions. Following this review, the section presents an overview of established frameworks used to measure collective competence, with the aim of identifying the most relevant dimensions for the current study.

### 2.3.1 DEFINITION AND THEORETICAL BACKGROUND

Collective competence draws from various theoretical frameworks such as distributed systems theory, cognition theory, and situated learning theory. First, collective competence can be understood as a system made up of interdependent parts, where the interaction between any of the parts will affect the whole (Ruuska & Teigland, 2009). Distributed systems theory provides a framework to understand organizations and project teams as complex systems formed by the interaction among their interdependent parts, including individuals, teams, processes, and resources:

> "As interaction occurs within larger groups of individuals, a structure of collective action emerges that transcends the individuals who constitute the collective. Therefore, collectives are open interaction systems, where actions and reactions determine the structure of the system" (Morgeson & Hofmann, 1999, p. 252)

Within the framework of distributed systems theory, collective competence emerges because of the interaction between these parts and the performance of the collective is a result of each individual team member. In other words, collective competences are considered the shared knowledge within a project team that enables successful project goal achievement (Ruuska & Teigland, 2009). As the project team collaborates together on the common objectives of the project, their collective competences will result in an outcome beyond the capabilities of an individual team member (Ruuska & Teigland, 2009). In other words, the collective competences of the project team, which emerge over time, result in enhanced project outcomes that go beyond what could be achieved by individual competences alone (Loufrani-Fedida & Missonier, 2015). "Each project team generates its own collective competence; it is of a different nature from the

strict sum of individual competencies…[and] it is built progressively during the project" (Loufrani-Fedida & Missonier, 2015, pp. 1228, 1229).

Cognition theory aligns with the propositions of distributed systems theory as it explains how learning occurs from the dynamic interactions between individuals, artifacts, the social environment, and technologies (Wood & Bandura, 1989). Here, the cognitive process is not an individual act but rather a collective act that is distributed across many resources:

> "human knowledge and cognition are not confined to the individual, nor uniformly learned by individuals. Instead, it is distributed by placing facts, or knowledge tags, and versions of memories, on individuals, tools, and objects in our environment" (Fadul, 2009, p. 212).

Finally, situated learning theory emphasizes learning through active participation in communities of practice. According to Lave and Wenger (1991), newcomers engage in a process called legitimate peripheral participation to integrate into a community of practice. This process involves immersing oneself in the community's activities to gradually deepen understanding and adopt its practices over time. Through this immersive experience, individuals transition from being on the periphery to becoming fully integrated members of the community that benefit and contribute to the collective knowledge of the group (Lave & Wenger, 1991). In the context of project management, many communities of practice serve to foster collective competence including professional associations like PMI and IPMA, where individuals come together to share best practices and collaboratively address challenges across the discipline. Additionally, within organizations, project teams and departments also form communities of practice to share knowledge, develop standard approaches to project management processes and work towards project goals.

In short, distributed system theory, cognition theory, and situated learning theory provide useful perspectives for understanding collective competence. They also serve to reconcile some of the intrinsic tensions surrounding the nature of competence. For instance, competence can be considered individual in nature, yet it can also be associated with and shared across a team. Moreover, competence can be independent of context while also dependent on its environment, like a community of practice. Embracing the coexistence of these tensions contributes to a richer understanding of competence.

### 2.3.2 COLLECTIVE COMPETENCE FRAMEWORKS

Despite evidence suggesting the importance of collective competence in achieving project success (Ruuska & Teigland, 2009; Ruuska & Vartiainen, 2003), there is a notable scarcity of collective competence models and frameworks both in the academic literature and in professional bodies of knowledge. In contrast to individual competence frameworks that are widely published by professional associations such as PMI and IPMA, professional bodies of knowledge do not offer a framework specifically tailored for collective competence. While IPMA acknowledges team competence in their various publications, it lacks a comprehensive framework for collective entities that bridges the gap between the individual and organizational level. With the absence of frameworks for collective competence that also persists in the existing literature (Macke & Crespi, 2016), the following paragraphs outline some of the efforts that shed light on the limited but important efforts to address this gap.

Ruuska and Teigland (2009) offer a framework for collective competence that consists of practical and interpersonal competence where practical competence is the team's ability to integrate individual skills and solving problems collaboratively, and interpersonal competence deals with the effective communication and collaboration among team members to accomplish project tasks. The individual competence profile combined with the competence of the other project members will determine the practical and interpersonal competence of the team. The results of case study conducted by Ruuska and Teigland (2009) on public-private partnerships showed that team competences such as shared project goals, collaboration, problem-solving skills, understanding of the big picture and a strong project leader are critical for strong team performance and creating conditions for project success (Ruuska & Teigland, 2009). Other examples of collective level competence include team resilience, creative problem solving (Carmeli et al., 2021), and ability to respond to complexity (Soderlund et al., 2008), which build the capabilities of the project teams to improve project performance.

Boreham (2011) introduced the triadic theory of collective competence as a framework for understanding how groups in in the workplace develop and maintain their collective competence. This framework emphasizes the dynamic process through which groups become collectively competent by combining individual and collective processes as well as individual and collective outcomes as depicted in Figure 2-2.

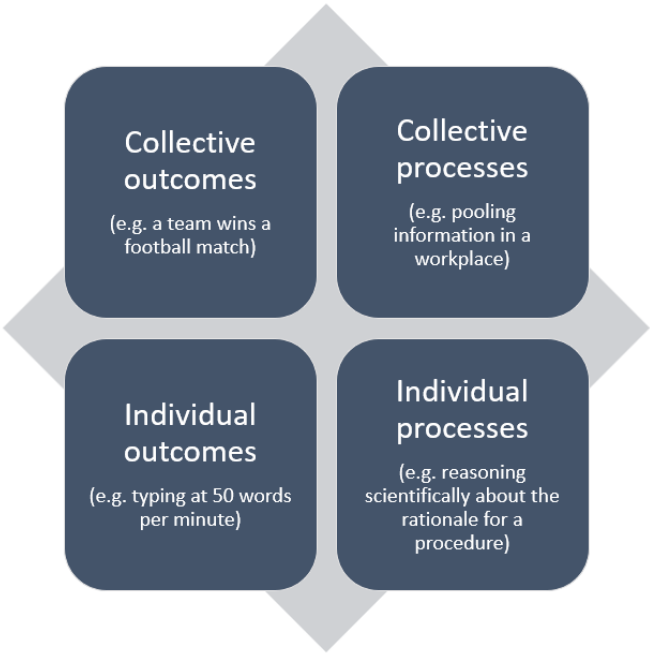



Figure 2-2: An extended family of competence concepts (Boreham, 2011, p. 79)

According to Boreham (2011), in order for a group to become collectively competent, they must: 1. *Make sense of events in the workplace*. This involves the shared understanding of objectives such as project goals. It requires members to engage in continuous shared dialogue and to maintain a collective mind; 2. *Develop and access a collective knowledge base*. This includes documented processes, procedures, and databases of information and lessons learned that members may draw upon. It also requires team members to reach consensus on their interpretations of shared experiences. The collective knowledge base is especially important as team compositions change over time, especially throughout long-term projects; and 3. *Maintain a sense of interdependency*. This involves not only team members considering their own individual needs but also the needs of other members and the project as a whole. By prioritizing the greater collective, the group can effectively navigate challenges and achieve shared objectives.

Macke and Crespi (2016) developed an instrument to measure collective competence for IT teams, that aligns closely with the foundational principles outlined in the triadic theory of collective competences. Relying on existing studies on collective competence, Macke and Crespi (2016) identify four factors that explain collective competence: proactivity, communication,

cooperation and interpersonal relationship, which is depicted in Figure 2-3. This framework serves as a useful tool for measuring the collective competence of a project team.

Given the scarcity of frameworks in both the literature and professional communities, the options for selecting a suitable framework at the collective level are limited. Ideally, selecting a model published by IPMA would have been preferred to maintain consistency with the framework chosen at the individual level. Despite this limitation, the instrument developed by Macke and Crespi (2016) emerges as a good choice as it aligns well with the competences selected at the individual level. Moreover, it provides adequate guidance for assessing competences at the collective level. Accordingly, the instrument proposed by Macke and Crespi (2016) is adopted as the measurement tool for this study. This selection ensures cohesion between the individual and collective competence assessment frameworks.

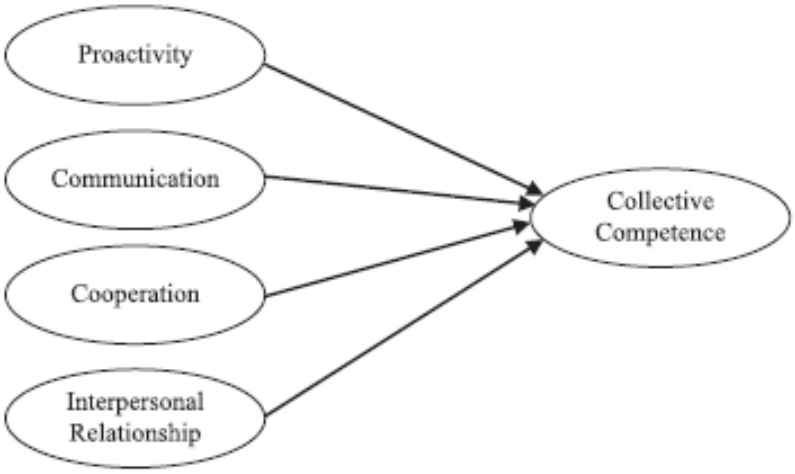



Figure 2-3: Measuring collective competence in IT teams (Macke & Crespi, 2016, p. 8)

### 2.3.3 SUMMARY

Table 2-7 presents the relevant dimensions of collective competence for this study, including a summary of both its definition and theoretical underpinnings. Moreover, at the collective level, this research adopts the instrument developed by Macke and Crespi (2016) to measure collective competence. Notably, the study centers on the four competences measured by this framework: Proactivity, Communication, Cooperation, and Interpersonal Relationship.

| **Collective Competence (Y)** | | **Reference(s)** |
|---|---|---|
| Definition | Shared knowledge within a project team that enables successful project goal achievement. | Ruuska and Teigland (2009) |
| Theoretical Background | Distributed System Theory | Morgeson and Hofmann (1999), Ruuska and Teigland (2009), Loufrani-Fedida and Missonier (2015) |
| | Cognition Theory | Wood and Bandura (1989), Fadul (2009) |
| | Situated Learning Theory | Lave and Wenger (1991) |
| Competence Framework | Instrument to measure collective competences in IT teams | Macke and Crespi (2016) |
| Measurable dimensions of collective competence | o Proactivity (PRO)<br>o Communication (COMM)<br>o Cooperation (COOP)<br>o Interpersonal Relationship (IR) | |

Table 2-7: Summary of Collective Competence

## 2.4 ORGANIZATIONAL COMPETENCE (Z)

This section begins by exploring the various definitions of organizational competence as presented in the academic literature as well as the professional bodies of knowledge. It also examines the theoretical foundations that inform these definitions. Following this review, the section presents an overview of established frameworks used to measure organizational competence, with the aim of identifying the most relevant dimensions for the current study.

### 2.4.1 DEFINITION AND THEORETICAL BACKGROUND

Organizational competence is rooted in the resource-based view of the firm, which seeks to integrate both the resource and product views of the firm within the organizational context (Wernerfelt, 1984). According to Wernerfelt (1984), understanding the firm's activities in the product market informs the minimum requirement of resources, while defining a resource profile enables the firm to discern appropriate product-market engagements. Ultimately, the objective is to discern scenarios where resources contribute to profit. Wernerfelt's (1984) resource-based

theory understands resources to be anything that constitutes a strength or a weakness for the firm including brand names, efficient procedures, skilled personnel, capital, and more.

Expanding on this theoretical foundation, Prahalad and Hamel (1990) introduced the concept of core competences, representing the tangible and intangible resources, knowledge, skills and processes within an organization that can influence its competitive advantage. Various scholars have since expanded on the notion of core competences, leading to the evolution of the widely-used term organizational competences (Davies & Brady, 2000; Loufrani-Fedida & Missonier, 2015). In the context of project-based organizations, organizational competence extend beyond the skills of individuals within the project team and are enduring over time, providing an organization with a competitive advantage, and contributing to the organization's overall success (Ruuska & Vartiainen, 2003). For project organizations, organizational competence also extend beyond the boundaries of a single project (Loufrani-Fedida & Missonier, 2015).

From the project management community of practice, definitions of organizational competence are limited. The IPMA Individual Competence Baseline (IPMA, 2016) provides an overview of individual, team, and organizational competence which allows practitioners to understand organizational competence within the broader perspective of collective and individual competence. These are summarized in Table 2-8.

| Competence Level | Definition |
|---|---|
| Individual competence | address the knowledge skills and abilities through experience |
| Team competence | address the collective performance of individuals joined toward a purpose |
| Organizational competence | address the strategic capabilities of a self-sustaining unit of people |

Table 2-8: IPMA overview of individual, team, and organizational competence

### 2.4.2 ORGANIZATIONAL COMPETENCE FRAMEWORKS

According to Chandler (1990), the core competences necessary to gain competitive advantage are strategic and functional capabilities. Strategic capabilities serve to both create and capitalize on business opportunities, while functional capabilities pertain to the application of necessary technologies and disciplines that are essential for the firm's operation (Bredin, 2008;

Chandler, 1990). The emergence of project-based organizations has also underscored the importance of project competence as an essential organizational competence (Davies & Brady, 2000; Soderlund, 2005). Soderlund (2005) uses the term project competence as an organization's ability to effectively execute projects. In a case study involving four large Swedish companies with project management as a core competence, Soderlund (2005) identified four building blocks critical for project operations: project generation, project organizing, project leadership and project teamwork. Conversely, Davies and Brady (2000) adopt the term project capabilities in reference to project competences, characterizing it as "important activities involved in supplying complex product systems" (p. 932). Another perspective on project capabilities is presented by Melkonian and Picq (2011) who describe it as "a two way relationship which recognizes that project management practices can and will influence organizational practices as well as the obvious reverse" (p. 458). The latter adopts a multilevel approach, acknowledging project capabilities as a complex process that evolves over time and is shaped by organizational strategy and learning through practice.

Building on the established competence framework of strategic, functional and project capabilities, Bredin (2008) recognizes the absence of a human resource dimension within the core competences of a project-based organization. As such, they propose a more comprehensive framework that includes people capabilities to form a tetrahedron of organizational competences that are highly interrelated, interdependent and all equally important. According to Bredin (2008), people capabilities is developed through people management systems that include "experience, individual skills, role structures, processes, activities and routines" (p. 574) across the organization. The proposed tetrahedron model, as illustrated in Figure 2-4, highlights the multifaceted nature of organizational competences and the integral role the people capabilities play alongside strategic, functional and project capabilities.

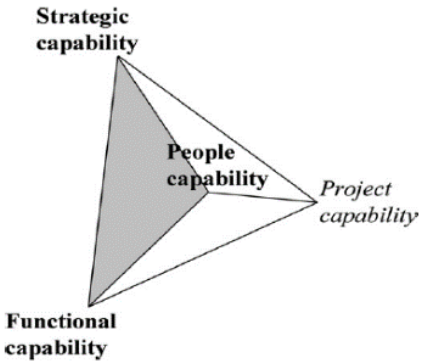



Figure 2-4: Tetrahedron of organizational capabilities (Bredin, 2008, p. 574)

Much like Bredin's (2008) tetrahedron model, the IPMA (2016) Organisational Competence Baseline (OCB) introduces an organizational competence framework that incorporates an elements focused on people. The IPMA framework proposes five organizational competences: PP&P Governance, PP&P Management, PP&P Organizational alignment, PP&P Resources, and PP&P People's competences as illustrated in Figure 2-5: below. PP&P Governance is concerned with corporate governance responsibility, encompassing aspects such as strategic communication, policy dissemination, and decision-making within the organization. PP&P Management focuses on the management systems deployed at different levels of the organization, ensuring efficient oversight of project, programs, and portfolios. PP&P organizational alignment involves aligning processes, structures, and cultures with internal and external parties. PP&P resources define resource requirements, assesses the current state of resources, and strategizes acquisition and development initiatives of resources. Finally, PP&P People competences deal with top management's goals and expectations regarding teamwork, communication, performance, and recognition.


Figure 2-5: Overview of organization competence in managing projects (IPMA, 2016, p. 49)

The adoption of the IPMA OCB for this research aligns with the IPMA ICB, which serves as the foundation for elaborating the construct of individual competence in this study. Moreover, to narrow the scope of the research, the intent is to select the PP&P People Competences to ensure cohesion between the individual, collective and organizational levels of competence assessment. The IPMA Organisational Competence Baseline provides further guidance on how to assess People Competences within the organization, which are useful for the data collection and analysis phases.

### 2.4.3 SUMMARY

Table 2-9 presents the relevant dimensions of organizational competence for this study, including a summary of both its definition and theoretical underpinnings. Moreover, at the organizational level, this research adopts the IPMA OCB as the framework for organizational competence assessment. Notably, the study centers on the PP&P People's Competence outlined within the framework.

| **Organizational Competence (Z)** | | **References** |
|---|---|---|
| Definition | The tangible and intangible resources, knowledge, skills and processes within an organization that can influence its competitive advantage | Prahalad and Hamel (1990) |
| | They extend beyond the skills of individuals within the project team and are enduring over time, providing an organization with a competitive advantage, and contributing to the organization's overall success | Loufrani-Fedida and Missonier (2015) |
| Theoretical Background | Resource-based theory of the firm | Wernerfelt (1984) |
| Competence Framework | IPMA Organisational Competence Baseline | IPMA (2016) |
| Measurable dimensions of organizational competence | ○People's Competences Requirements (PCR)<br>○People's Competences State (PCS)<br>○People's Competences Acquisition (PCA)<br>○People's Competences Development (PCD) | |

Table 2-9: Summary of Organizational Competence

## 2.5 SPECIFIC RESEARCH QUESTIONS, ABDUCTIVE WORKING HYPOTHESES AND CONCEPTUAL FRAMEWORK

With definitions of individual, collective and organizational competence now established, this section leverages insights from existing studies that shed light on the nature of the relationship between individual, collective, and organizational competence. The goal is to extract relevant findings from these studies to formulate hypotheses that address the research questions for this study.

Moreover, it is important to note that the preferred approach is to examine the correlation between pairs of variables, rather than all variables at once. This approach offers an understanding of the underlying structures and processes that connect these pairs of variables. As the number of variables under consideration increases to three, as is the case with this study, the analysis of their combined relationships can become increasingly complex. Accordingly, sub-sections 2.5.1-2.5.6 examine these relationships as singular associations. This will help to uncover useful insights that may serve as building blocks to potentially guide future research to unravel the complexities

inherent in the broader network of relationships under investigation. Sub-section 2.5.7 considers the relationship between the combination of the three levels of competence for future research. This section culminates with hypotheses and a conceptual framework that serve as the basis for this study.

### 2.5.1 H1-1: INDIVIDUAL COMPETENCE (X) INFLUENCES COLLECTIVE COMPETENCE (Y)

Learning processes play a key role in connecting competence levels (Lundin & Soderholm, 1995; Melkonian & Picq, 2011). In this regard, the framework by Wiewiora et al. (2019) sheds light on the multilevel flow of learning within project organizations and how it impacts competence development between the individual and collective levels. The authors identified two learning orientations between the individual and collective level: feed-forward learning involving individuals exploring new knowledge that later becomes integrated into the collective level and feedback learning that leverages collective knowledge to make it accessible to individuals. Wiewiora et al. (2019) identified both feed-forward and feedback relationships between the individual and collective levels facilitated by factors such as culture, leadership, political dynamics, and shared mental models. This section focuses specifically on the feed-forward relationship as this will give insight into understanding the influence that individual competence may have on collective competence.

First, culture plays a role in the feedforward relationship between the individual and collective level. Defined as the "practices, symbols, values and assumption that the organization's members share in regard to appropriate behavior" (Wiewiora et al., 2019, p. 102), culture significantly influences learning throughout the organization because it affects the "patterns and qualities of social interaction" (Wiewiora et al., 2019, p. 102). Cultures of flexibility, experimentation, and risk-taking were found to have a positive influence while bureaucratic cultures that focus on control and top-down decision making were found to have a negative influence. For example, Wiewiora et al. (2019) highlights the results of a study conducted by Edmondson (2002), where a team's culture of blame prevented individuals from speaking up and expressing their opinion in a group situation, affecting their ability to learn as a team.

Second, leaders are characterized as individuals that hold a lot of power and influence in the organization. Authentic, transactional, and transformational leaders positively influenced the learning between individuals and teams as these types of leaders foster working environments that facilitate learning opportunities (Wiewiora et al., 2019). Conversely, leaders who retain power and control exert a negative influence on all levels of learning as they create an environment where members are hesitant to take risks, experiment and share with others (Wiewiora et al., 2019). Accordingly, the leadership style of the project manager will influence the feedforward relationship between individuals and the collective team.

Political dynamics essentially refers to "the dynamics of power in an organization" (Wiewiora et al., 2019, p. 105). It encompasses both wide politics, described as "politics as an exercise of power to influence behaviours or processes" (Wiewiora et al., 2019, p. 105) and narrow politics, defined as "a dysfunctional behaviour that is strategically designed to maximize short-term or long-term self-interest" (Wiewiora et al., 2019, p. 105). Political interventions can have a positive or negative impact on learning. For instance, in a project environment, some leaders may favour accelerating the pace of the project over a potentially slower trajectory that could offer more learning opportunities; thus, negatively impacting the flow of learning.

Lastly, shared mental models are "deeply held internal images of how the world works; those images often limiting us to familiar ways of thinking and acting" (Wiewiora et al., 2019, p. 106). While research on shared mental models in the project management literature is limited, Wiewiora et al. (2019) believe it to be beneficial for transferring knowledge from the individual to the team level. For instance, individuals that share their mental models with the team may enhance the overall collective knowledge.

Based on the framework by Wiewiora et al. (2019), the evidence of a feed-forward learning flow between the individual and collective levels within an organization highlights the interconnectedness amongst these two levels. Several factors such as culture, leadership, political dynamics, and shared mental models have the potential to facilitate or hinder the flow of learning from individuals to teams. Given this evidence, we can also assume that individual and collective competence have a similar relationship, where individual competence has the potential to influence collective competence. Accordingly, the following abductive working hypothesis concerning the

nature of the relationship from individual competence to collective competence is formulated as follows:

**H1-1: Individual competence (X) influences collective competence (Y).**

### 2.5.2 H1-2: COLLECTIVE COMPETENCE (Y) INFLUENCES INDIVIDUAL COMPETENCE (X)

Similarly, the feedback learning flow between the individual and collective levels of an organization in the framework by Wiewiora et al. (2019) provide evidence that collective competence may also influence individual competence. Specifically, shared mental models are not only useful for transferring knowledge from the individual to the team level but also facilitate the transfer of knowledge from the team level to the individual level. For example, using integrated scheduling systems and other tools can facilitate a shared understanding at both the individual and team level. Accordingly, the following abductive working hypothesis concerning the nature of the relationship from collective competence to individual competence is formulated as follows:

**H1-2: Collective competence (Y) influences individual competence (X).**

### 2.5.3 H2-1: COLLECTIVE COMPETENCE (Y) INFLUENCES ORGANIZATIONAL COMPETENCE (Z)

The study by Melkonian and Picq (2011) offers valuable insights into the recursive relationship between collective and organizational competence. Focusing on the Special Forces as a case study, this research examines how organizational project capabilities are shaped from a multilevel perspective. The research builds on the tensions between the dynamic and routine aspects inherent in PBOs, where there is a need to preserve organizational routines while also fostering innovative environment for projects to succeed. In this study, projects are the multiple missions carried out by the soldiers, and the permanent organizational structure is the Special Forces. The research depicts project capabilities as a double-loop structure with both top-down and bottom-up dimensions. The findings of the case study show that the performance of the Special Forces team is influenced by both top-down and bottom-up dimensions of project capabilities; thus, validating that a dynamic and recursive relationship exists between the collective and organizational levels. This section examines the bottom-up dimensions of project capabilities

to shed light on the nature of influence that collective competence may have on organizational competence.

The bottom-up dimension of project capabilities emphasizes the dynamic aspects of PBOs, specifically how projects can stimulate innovation and drive organizational change. For instance, debriefing sessions conducted after missions play a crucial role in organizational learning. They may result in adjustments to organizational routines as well as decisions regarding resource allocation and restructuring processes within the organization (Melkonian & Picq, 2011). These organizational adjustments contribute to improving the collective performance of future missions, emphasizing the importance of continuous improvement and adjustment that occurs between the collective and organizational levels.

Revisiting the study by Wiewiora et al. (2019) is also useful for understanding the relationship between collective and organizational competence. The literature review found that organizational structure and political dynamics influence the feed-forward flow of learning between the collective and organizational level. Like the flow of learning between the individual and organizational level, political dynamics also influence learning opportunities between the collective and organizational level (Wiewiora et al., 2019).

Moreover, organizational structure, defined by Wiewiora et al. (2019) as "the roles and responsibilities of the organizational members and teams, and determines how an organization allocates resources and interacts with the environment" (p. 104), is also an influential mechanism for learning. Decentralized structures offer more separation between teams and the rest of the organization. This isolates teams from organizational routines, encouraging them to innovate and learn, when compared to centralized structures (Wiewiora et al., 2019). Within PBOs, given that most learning remains within a project, a centralized project management office (PMO) is beneficial for bridging project and organizational learning. Likewise, Badi (2022) carried out a study showing that organisational culture has an influence on collective coping strategies for project teams in the construction industry.

Based on the findings of these existing studies, the following abductive working hypothesis is formulated to understand the nature of the influence from collective competence to organizational competence:

**H2-1: Collective competence (Y) influences organizational competence (Z).**

### 2.5.4 H2-2: ORGANIZATIONAL COMPETENCE (Z) INFLUENCES COLLECTIVE COMPETENCE (Y)

Revisiting the study by Melkonian and Picq (2011), the existence of the top-down dimension of project capabilities emphasizes the stable features of the PBO, such as strategies and processes that guide project activities at the collective level. For instance, the top-down dimension of project capabilities relies on HR processes that ensure the selection and continuous training of highly skilled individuals. Specifically, these organizational processes impact the training of individuals and teams throughout their career. This aligns with Fragmentation for commitment-building phase in the theory by Lundin and Soderholm (1995), where actors and competences are identified by the organization as well as the People Capability at the organizational level which uses internal processes to develop and select a project manager (Bredin, 2008).

The study by Wiewiora et al. (2019) also provides insight into how leadership style influences the feedback learning flow between the organization and the team. Specifically, the authors refer to a study by Vera and Crossan (2004) that found that both transformational and transactional leadership have a positive influence on the flow of learning from the organization to the team. Transformational leaders facilitate team learning during transition periods because they are good at promoting a new strategic vision. Alternatively, transactional leaders are best suited at reinforcing existing organizational routines to impact team learning.

The findings by Melkonian and Picq (2011) and Vera and Crossan (2004) offer evidence of an existing relationship from organizational competence to individual competence. Accordingly, the following abductive working hypothesis is formulated to understand the nature of the influence from collective competence to organizational competence:

**H2-2: Organizational competence (Z) influences collective competence (Y).**

### 2.5.5 H3-1: INDIVIDUAL COMPETENCE (X) INFLUENCES ORGANIZATIONAL COMPETENCE (Z)

The research conducted by Wiewiora et al. (2019) also provides evidence supporting a dynamic relationship between individual and organizational competence. Their findings examine how culture, organizational structure and political dynamics facilitate feed-forward learning between the individual and collective level, with leaders assuming a critical role in promoting both feed-forward and feedback learning across these levels. Specifically, a culture that prioritizes continuous learning and knowledge-sharing promotes an environment where individuals feel more comfortable expressing their ideas. This open space fosters a collaborative environment where individuals are encouraged to share their ideas, and the organization is more receptive to actively incorporating these ideas to shape future directions. Additionally, organizational structure, particularly decentralized structures, is believed to improve the sharing of individual learning to the organizational level. Political dynamics, characterized by transparent decision-making processes and merit-based recognition of individual contributions, bolster trust and motivation; thus, fostering competence development. Leaders play a vital role in facilitating both feed-forward and feedback learning between the individual and organizational level. On the one hand, leaders can introduce policies and procedures that affect organizational competence.

Based on the findings of Wiewiora et al. (2019) and Melkonian and Picq (2011), the following abductive working hypothesis is formulated to understand the nature of the influence between individual competence and organizational competence:

**H3-1: Individual competence (X) influences organizational competence (Y).**

### 2.5.6 H3-2: ORGANIZATIONAL COMPETENCE (Z) INFLUENCES INDIVIDUAL COMPETENCE (X)

Returning to the topic of leadership in the study by Wiewiora et al. (2019), transformational and transactional leaders not only facilitate learning from the organizational level to the team level, but also extends the flow of learning to the individual level. For instance, leaders who enforce organizational routines contribute to feedback learning, influencing individual competence.

Moreover, recalling insights from the study by Melkonian and Picq (2011), organizational HR processes also influence the training of individuals throughout their career; thus, shaping the

competence of individuals over time. Based on these findings and those of Wiewiora et al. (2019), the following abductive working hypothesis is formulated to understand the nature of the influence from organizational competence to individual competence:

**H3-2: Organizational competence (Y) influences individual competence (X).**

### 2.5.7 HYPOTHESES FOR FUTURE RESEARCH

The framework by Loufrani-Fedida and Missonier (2015) offers a unique perspective on the combined influence of organizational and individual competencies in shaping collective competences. Loufrani-Fedida and Missonier (2015) conducted case studies involving four new product development firms to investigate PBO competences and their relationships with the individual, collective, and organizational levels of competence. Their research design involved two units of analysis (integrative and functional competences) and three levels of competences (individual, project team, and organization). According to Loufrani-Fedida and Missonier (2015), functional competence refers to the ability to establish specialized technical knowledge within the organization that function independently of each other while integrative competence involves combining and coordinating these functional competencies to ensure collaboration across different parts of the organization.

Notably, the study challenges the conventional idea that collective competence mediates the relationship between individual competence and organizational processes. Instead, the results show that the collective competence of the project team stems from individual functional competencies, organizational integrative competencies, and collective mechanisms such as documentation and communication as illustrated in Figure 2-6 below.

> "The collective competence does not exist at the beginning of the project; it is built during the project as a result of the interactions between individual and organizational competencies, and the development of collective mechanism" (Loufrani-Fedida & Missonier, 2015, p. 1232).

In other words, team competence evolves from the functional competencies executed by individuals within the project, that are coordinated through organizational integrative competencies and facilitated by collective mechanisms such as documents and artefacts.

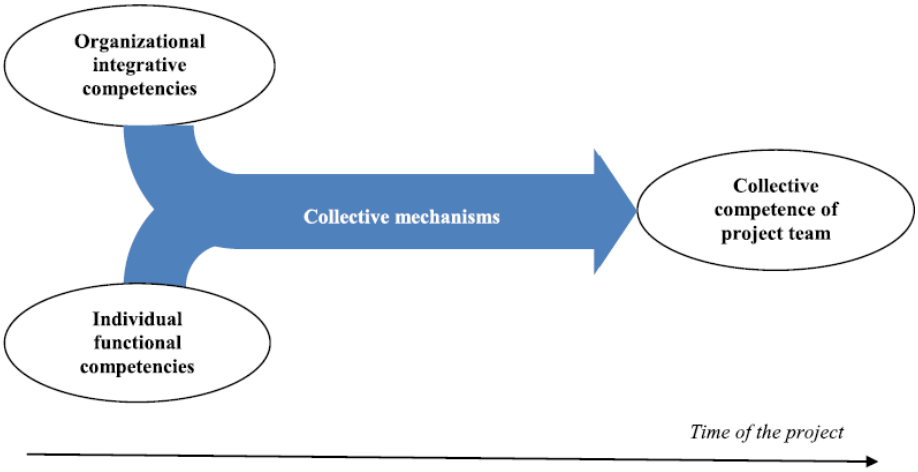



Figure 2-6: Multilevel approach of competencies within a project (Loufrani-Fedida & Missonier, 2015, p. 1230)

Overall, the framework by Loufrani-Fedida and Missonier (2015) provides valuable insight into how organizational and individual competences, combined together, contribute to shaping collective competence. While this provides a good foundation for future research, analyzing the combined relationships among the three variables is beyond the scope of this present study. Given the complexity of interpreting multiple interconnected variables, this research focuses on examining the correlation between pairs of variables to better understand their individual influences.

### 2.5.8 SUMMARY OF SPECIFIC RESEARCH OBJECTIVES, SPECIFIC RESEARCH QUESTIONS, ABDUCTIVE WORKING HYPOTHESES AND CONCEPTUAL FRAMEWORK

The literature review in the previous section provides valuable insights into the existing multilevel research on competence that facilitates the formulation of several abductive working hypotheses to address the specific research questions central to this study. The validation of these hypotheses is useful for developing a holistic framework that sheds light on how competence is shaped across multiple levels. Table 2-10 below summarizes the specific research objectives, specific research questions and abductive working hypotheses for this study.

| Specific Research Objectives | Specific Research Questions | Abductive Working Hypotheses | References |
|---|---|---|---|
| Understand the relationship between individual competence (X) and collective competence (Y) | RQ1: What is the nature of the influence between individual competence (X) and collective competence (Y)? | H1-1: Individual competence (X) influences collective competence (Y). | Wiewiora et al. (2019) |
| | | H1-2: Collective competence (Y) influences individual competence (X). | |
| Understand the relationship between collective competence (Y) and organizational competence (Z) | RQ2: What is the nature of the influence between collective competence (Y) and organizational competence (Z)? | H2-1: Collective competence (Y) influences organizational competence (Z). | Melkonian and Picq (2011), Wiewiora et al. (2019) |
| | | H2-2: Organizational competence (Z) influences collective competence (Y). | |
| Understand the relationship between individual competence (X) and organizational competence (Z) | RQ3: What is the nature of the influence between individual competence (X) and organizational competence (Z)? | H3-1: Individual competence (X) influences organizational competence (Z). | Wiewiora et al. (2019), Melkonian and Picq (2011) |
| | | H3-2: Organizational competence (Z) influences individual competence (X). | |

Table 2-10: Summary of specific research objectives, specific research questions & abductive hypotheses

The proposed conceptual framework for this study, illustrated in Figure 2-7, includes three variables: individual competence (X), collective competence (Y), and organizational competence (Z). Building on the existing literature, abductive working hypotheses have been formulated with regards to the relationships between the variables. The basis of this framework stems from Figure 1-3. This framework helps to understand how much influence competence levels have on one another.

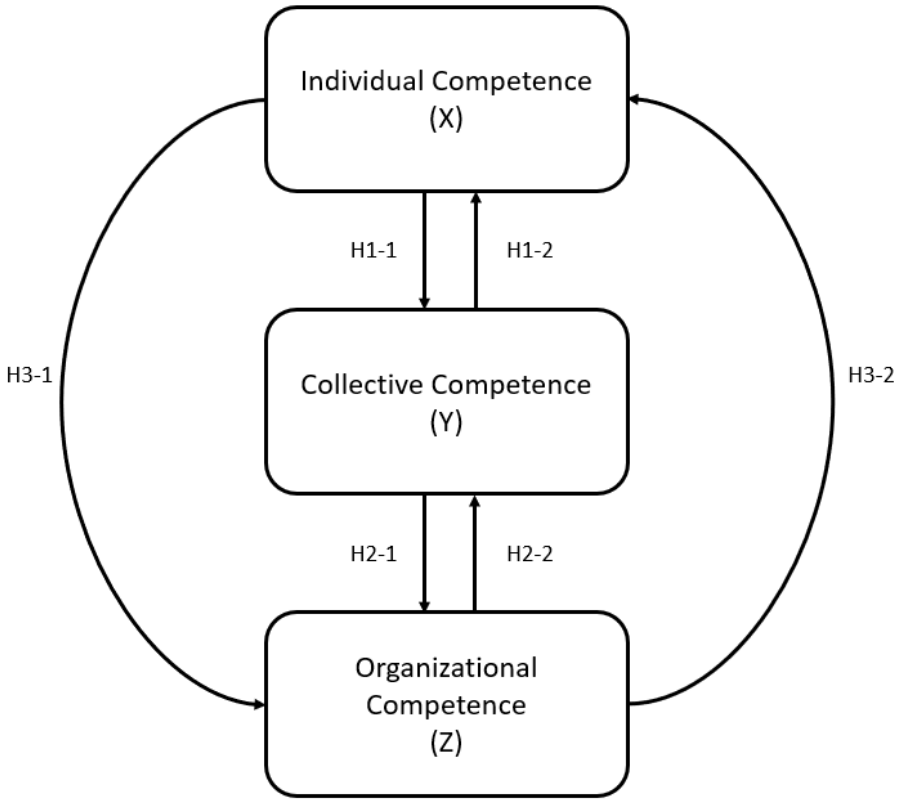



Figure 2-7: Proposed Conceptual Framework

# CHAPTER 3 : OPERATIONAL FRAMEWORK

Chapter 3 defines the operational framework, which essentially explains how the research is conducted using pragmatic inquiry. The research choices for this study are based on the values of the researcher as well as practical considerations, which are discussed further in this chapter. The operational framework is a natural extension of the theoretical framework and is outlined in Table 3-1.

Section 3.1 explores the process of pragmatic inquiry. Section 3.2 describes the research approach, which applies a combination of abduction, deduction, and induction processes that are carried out in the context of this research. This section also provides an overview of the research design, focusing on quantitative research methodology and a research strategy consisting of a survey as well as a cross-sectional time-horizon. Data is anticipated to be collected using a self-completion questionnaire and analyzed using Partial Least Squared (PLS).

| | | | | |
|---|---|---|---|---|
| **THOERETICAL FRAMEWORK** | 2.1.1 | Research Philosophy | Pragmatism | Farjoun et al. (2015), Lorino (2018) |
| | 2.1.2 | Ontological Perspective | Becoming | Tsoukas and Chia (2002), Linehan and Kavanagh (2006) |
| | 2.1.3 | Epistemological Perspective | Process View | Langley et al. (2013), Brunet et al. (2021) |
| | 2.1.4 | Theories Mobilized | Temporary Organization | Lundin and Soderholm (1995), Vestola et al. (2021) |
| | 2.1.5 | Level of Analysis | Individual, collective and organizational | |
| | 2.1.5 | Unit of Analysis | Competence | |
| | | ⇩ | | |
| **OPERATIONAL FRAMEWORK** | 3.1 | Process of Inquiry | Pragmatic Inquiry | Lorino (2018), Kelly and Cordeiro (2020), Gillespie et al. (2024) |
| | 3.2 | Research Approach | Abductive | Lorino (2018), Gillespie et al. (2024), Bell (2019), Kovacs and Spens (2005) |
| | 3.2.2.1 | Research Methodology | Quantitative | Mitchell (2018), Bell (2019), Gillespie et al. (2024) |
| | 3.2.2.2 | Time Horizon | Cross-sectional | Bell (2019) |
| | 3.2.2.3 | Data Collection | Survey | Bell and Bryman (2018) |
| | 3.2.2.4 | Data Analysis | PLS-SEM | Sarstedt et al. (2019), Hair et al. (2011), Sarstedt et al. (2017), Fernandes (2012) |

Table 3-1:Theoretical and Operational Framework

## 3.1 PRAGMATIC INQUIRY

The operational framework for this research is grounded in pragmatic inquiry. Pragmatic inquiry advocates for studies to produce knowledge that is both useful and actionable in real-world contexts (Kelly & Cordeiro, 2020). In other words, pragmatic inquiry is concerned with knowledge that extends beyond the academic context to "improve the human condition more broadly" (Gillespie et al., 2024, p. 21). Through the perspective of Peirce and Dewey, Lorino

(2018) explains how pragmatic inquiry transforms an incoherent situation into a coherent one, as illustrated in Figure 3-1. An incoherent situation generates doubt, which triggers an inquiry to make sense of the incoherent elements within the situation, ultimately connecting these elements in a way that makes sense to create a determinate situation (Lorino, 2018). It is important to note that this process is recursive where the situation is continuously reassessed and redefined as doubts inevitably continue to emerge within the present situation.

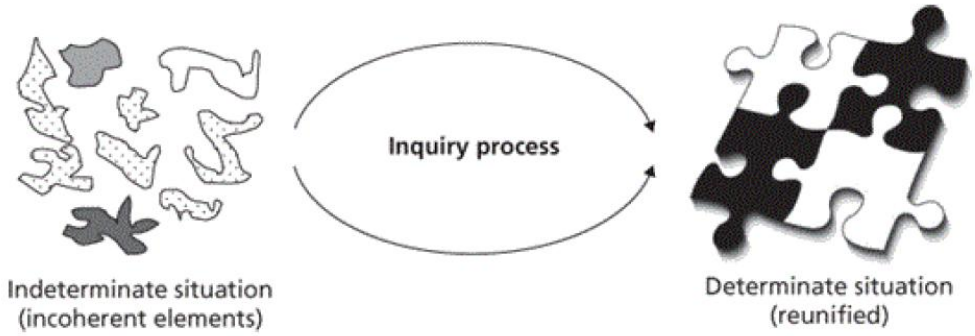



Figure 3-1: Pragmatic inquiry transforms an indeterminate situation into a reunified whole (Lorino, 2018, p. 103)

## 3.2 RESEARCH APPROACH

The research approach essentially defines "the relationship between the theory and the research" (Bell, 2019, p. 20). Traditionally, the two main approaches to a research study are deductive and inductive reasoning. The process of deduction is normally tied to the objectivist-positivist paradigm where an established theory informs the observations and the findings of the study while the process of induction is where the theory is drawn from observations and the findings of the study that is typically associated with qualitative research. The main challenge with both approaches is that they are linear, thus implying that the researcher has established and collected the correct information along the way. In the case of deduction, there is no guarantee that the correct theory was selected as the starting point for the research. In the case of induction, it may be flawed to generalize empirical data in order to develop a theory (Mitchell, 2018).

To overcome the limitations of the deductive and inductive approach, a third type of inference called abduction was introduced. Figure 3-2 summarizes these three research approaches. The abductive approach is thought to be a more realistic and intuitive approach,

allowing the opportunity for back-and-forth engagements with the real-world (Bell, 2019; Kovacs & Spens, 2005). Lorino (2018) distinguishes between the three types of inferences as follows:

> "Contrary to deduction, which moves from general to particular, or induction which moves from particular to general, the conclusion of abductive reasoning tells us something more than what was already known in the premise. Abduction invents something new, a distinct law, a different story" (Lorino, 2018, p. 193).

While some researchers argue that these three types of reasoning are opposing, pragmatic inquiry values the use of abduction, deduction and induction when used together: "Abandoning any mode of inference would be antipragmatist, because it would be a tribal affiliation to one form of inference; it would fail to leverage the insight that each mode of inference can provide" (Gillespie et al., 2024, p. 93).

| | Deduction | Induction | Abduction |
|---|---|---|---|
| **Logic** | In a deductive inference, when the premises are true, the conclusion must also be true | In an inductive inference, known premises are used to generate untested conclusions | In an abductive inference, known premises are used to generate testable conclusions |
| **Generalisability** | Generalising from the general to the specific | Generalising from the specific to the general | Generalising from the interactions between the specific and the general |
| **Use of data** | Data collection is used to evaluate propositions or hypotheses related to an existing theory | Data collection is used to explore a phenomenon, identify themes and patterns and create a conceptual framework | Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth |
| **Theory** | Theory falsification or verification | Theory generation and building | Theory generation or modification; incorporating existing theory where appropriate, to build new theory or modify existing theory |

Figure 3-2: Summary of deduction, induction, and abduction research approach (Saunders et al., 2019, p. 153)

Pragmatic inquiry is a non-linear process that involves a combination of abduction, deduction, and induction (Gillespie et al., 2024; Lorino, 2018) According to Lorino (2018), following the identification and problematization of an incoherent situation, abduction, deduction, and induction are applied to develop working hypotheses, testable propositions, and experimental protocols respectively, as illustrated in Figure 3-3. Similarly, Gillespie et al. (2024), highlight the

synergistic relationship between the three types of inferences: “Deduction leverages the past to generate expectations; abduction generates ideas that escape the confines of deductive expectation; and induction tames unfounded expectations and excessive speculation” (p. 94).

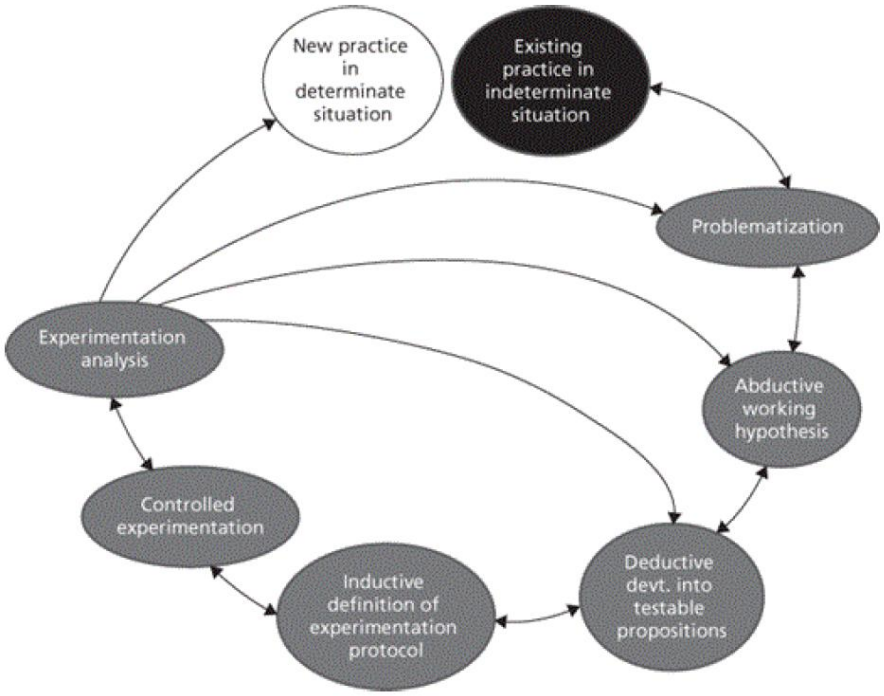



Figure 3-3: The elements of pragmatic inquiry (Lorino, 2018, p. 113)

First, abduction seeks to establish plausible narratives, also referred to as abductive working hypotheses, to make sense of the incoherent elements within a situation : “To unify scattered elements, abduction tries to establish relations, in particular causal relations, where they do not clearly appear.” (Lorino, 2018, p. 195). These narratives are not necessarily true, but are used to initiate the process of inquiry, and can be revisited throughout the process: “The result of abduction is a belief which new facts may invalidate” (Lorino, 2018, p. 194). The process of abductive inference was carried out in Section 2.5, where a literature review enabled the formulation of seven abductive working hypotheses concerning the nature of the relationship between individual, collective, and organizational competence. Table 3-2 summarizes these abductive working hypotheses.

| | Relationship | Abductive Working Hypotheses |
|---|---|---|
| H1-1 | X→Y | Individual competence (X) influences collective competence (Y) |
| H1-2 | Y→X | Collective competence (Y) influences individual competence (X) |
| H2-1 | Y→Z | Collective competence (Y) influences organizational competence (Z) |
| H2-2 | Z→Y | Organizational competence (Z) influences collective competence (Y) |
| H3-1 | X→Z | Individual competence (X) influences organizational competence (Z) |
| H3-2 | Z→X | Organizational competence (Z) influences individual competence (Y) |

Table 3-2: Summary of abductive hypotheses

The next step applies deductive reasoning to transform the abductive hypotheses into testable propositions. This involves reformulating each hypothesis into measurable statements that can be evaluated through quantitative methods. Each proposition specifies a statistically testable relationship among the three key constructs. A summary of the abductive working hypotheses and their corresponding testable propositions is presented in Table 3-3.

| | Relationship | Abductive Working Hypotheses | | Testable Propositions |
|---|---|---|---|---|
| H1-1 | X→Y | Individual competence (X) influences collective competence (Y) | P1-1 | Individual competence (X) has a statistically significant influence on collective competence (Y) |
| H1-2 | Y→X | Collective competence (Y) influences individual competence (X) | P1-2 | Collective competence (Y) has a statistically significant influence on individual competence (X) |
| H2-1 | Y→Z | Collective competence (Y) influences organizational competence (Z) | P2-1 | Collective competence (Y) has a statistically significant influence on organizational competence (Z) |
| H2-2 | Z→Y | Organizational competence (Z) influences collective competence (Y) | P2-2 | Organizational competence (Z) has a statistically significant influence on organizational competence (X) |
| H3-1 | X→Z | Individual competence (X) influences organizational competence (Z) | P3-1 | Individual competence (X) has a statistically significant influence on organizational competence (Z) |
| H3-2 | Z→X | Organizational competence influences individual competence | P3-2 | Organizational competence (Z) has a statistically significant influence on individual competence (Y) |

Table 3-3: Abductive working hypotheses and testable propositions

Finally, induction is used to establish the research design, which sets out the conditions of the experiment to test the testable propositions: "Induction relates the specific conditions of experimentation, a set of particular cases, with the generic nature of the tested proposition, by defining agreed upon conditions of validity" (Lorino, 2018, p. 115). Accordingly, the research design for this study is presented in Section 3.2.2

### 3.2.1 MULTILEVEL RESEARCH

The intent of this section is to provide a broad understanding of multilevel research and identify some considerations specific to this study. The evolution of multilevel research emerged in the late twentieth century out of a growing recognition of the limitations in studying organizational phenomena from a single level of analysis and the need for a richer understanding of complex organizational dynamics (Mathieu & Chen, 2011). While research today still predominantly examines organizational phenomena at the single level of analysis, Hitt et al. (2007) argue that adopting a multilevel lens is instrumental in providing a more holistic account of these phenomena:

> "Using a multilevel lens reveals the richness of social behavior; it draws our attention to the context in which behavior occurs and illuminates the multiple consequences of behavior traversing levels of social organization" (p. 1385)

The concept of multilevel research is the existence of a hierarchical system with entities organized in a nested structure with two or more layers (Hitt et al., 2007; Molina-Azorin et al., 2020). This perspective acknowledges that variables in one level may influence variables at another level. For instance, Molina-Azorin et al. (2020) uses the example of employee performance, where characteristics of the employee at the lower level such as job satisfaction and motivation, can impact employee performance. Moreover, employee performance may also be influenced by higher-level variables such as team cohesion. Along the same lines, team performance can also be influenced by the characteristics of individual employees at the lower level.

As illustrated in Figure 3-4, Molina-Azorin et al. (2020) explain that each level is typically represented by a numerical value where the higher levels correspond to larger numbers and lower levels correspond to smaller numbers. The micro level normally corresponds with the lowest level

and is characterized by the greatest number of units (individuals). Conversely, the macro levels correspond to the higher levels and are comprised of fewer units due to the presence of fewer groups and organizations compared to individuals at the micro level and typically have less units as there are less groups and organizations than there are individuals. Figure 3-4 also shows antecedents and outcomes at multiple levels that are all related to some business aspect, in this case firm capability.

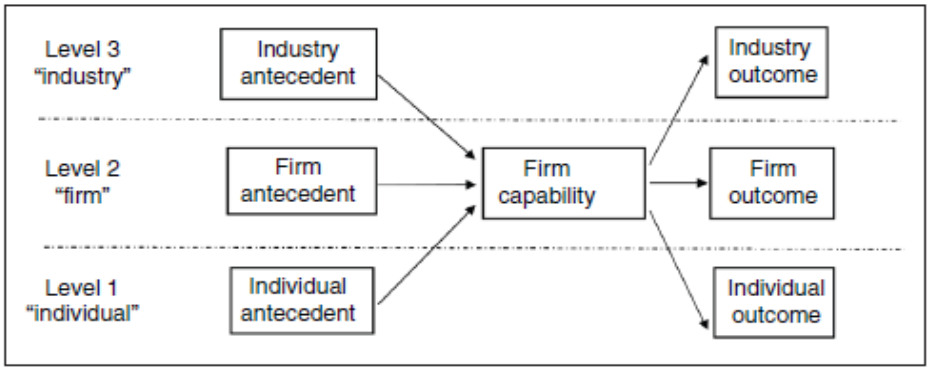



Figure 3-4: Multilevel antecedents and outcomes of firm capability (Molina-Azorin et al., 2020, p. 324)

Using a multilevel approach presents many challenges that must be carefully considered when carrying out research. The following paragraphs focus on three challenges that have garnered a lot of attention in the literature: scope definition, collective boundaries, and appropriate generalization of the findings. Consideration of these challenges and how to overcome them is necessary to support the validity of the research findings.

One of the main challenges highlighted by Klein et al. (1999) in adopting a multilevel approach is appropriately scoping the research. Navigating a middle ground between overly simple and excessively complex multilevel frameworks can be difficult:

> "We know that when individuals do x, y occurs. Therefore, when groups do x, y must also occur. Such a simple translation may not yield profound theoretical insights. At the opposite extreme are multilevel theories of overwhelming complexity, describing a jumble of moderating and mediating variables and relationships at several levels of analysis. The central insights from these theories may be overshadowed by the number of relationships

posited in the model. The appropriate middle ground—not too simple, yet not too complex—may be difficult to find" Klein et al. (1999, p. 244).

Therefore, the goal is to carry out multilevel research that is well-balanced and that provides meaningful contribution to understanding complex organizational phenomena.

Another challenge in multilevel research involves defining the boundaries of collectives, which can be more difficult compared to defining the boundaries of individuals. Discerning where one group ends and the other begins and when they have moved beyond a level of analysis presents a challenge (Hitt et al., 2007; Loufrani-Fedida & Missonier, 2015; Mathieu & Chen, 2011). Moreover, the stability or instability of group membership may create a situation where team composition at the end of a project has little overlap with that at the beginning. "Early- and later-period team members may have all contributed to the outcomes yet never worked together" (Mathieu & Chen, 2011, p. 624).

Lastly, researchers need to be careful when generalizing their findings in the context of a multilevel approach. Referred to as the fallacy of the wrong levels, there is a potential risk for misinterpretation of the findings when they are generalized at the wrong level (Klein et al., 1999; Molina-Azorin et al., 2020). Molina-Azorin et al. (2020) highlight a specific instance of this fallacy, emphasizing the error in interpreting the results of the organizational relationships and generalize them at the individual employee level. To overcome this challenge effectively, it is imperative to align the level of theory, level of measurement, and level of analysis.

Ultimately, the adoption of a multilevel approach for studying project management competence promises to result in a more comprehensive understanding of how they are shaped. With that said, there are challenges that need to be considered and addressed when carrying out multilevel analysis. This research is designed with these considerations in mind.

### 3.2.2 RESEARCH DESIGN

"A research design provides a framework for the collection and analysis of data" (Bell, 2019, p. 45). In other words, it explains how the research is conducted, including selecting a research methodology, a time horizon, and identifying tools for data collection and analysis. Accordingly, the following subsections present and justify the research choices for this study,

including the selected research methodology and time horizon as well as the approach and tools used for the data collection and data analysis.

#### 3.2.2.1 RESEARCH METHODOLOGY

The two predominant research methodologies that emerge from empirical studies are quantitative and qualitative. Quantitative research normally assumes an objective reality and uses a deductive approach to verify a hypothesis comprised of variables and relationships to seek a causal explanation (Mitchell, 2018). Qualitative research typically assumes a subjective reality and uses an inductive approach that seeks to understand the subject's perspective and culminates with a hypothesis or grounded theory (Mitchell, 2018). According to Malina et al. (2011), quantitative research addresses the *how often* and *how many* while qualitative research addresses the *how* and the *why*. While some researchers like Guba and Licoln (1994) believe that these two paradigms are incompatible, others like Maxwell (2013) believe that a bricolage approach that combines several philosophical positions provides a deeper understanding of the world. In fact, combining quantitative and qualitative research strategies often results in a stronger outcome as it allows the researcher to explore more complex aspects of the problem at hand (Malina et al., 2011; Schoonenboom, 2018).

While there has traditionally been a strong connection between specific epistemological and ontological assumptions and the choice of research methods, this predisposition should not be considered as definitive (Bell, 2019). Here, Bell (2019) is referring to the typical research grounded in positivist roots that applies a quantitative research methodology and research anchored in constructivism that adopts a qualitative research approach. "Most research, even when grounded primarily in one epistemological position, does engage with or at least acknowledge other approaches" (Gillespie et al., 2024, p. 31). Ultimately, quantitative and qualitative methodologies should be viewed as complementary rather than opposing: "It is precisely because each mode of inference and method does something different, and answers different questions, that they are complementary rather than competing" (Gillespie et al., 2024, p. 94).

There are several reasons why this research relies on quantitative methods to collect and analyze the data. Primarily, this study is concerned with understanding how much one construct influences another construct. In particular, the intent is to shed light on how much competence at

one level influences competence at another level. A quantitative approach facilitates the measurement and analysis of these measurements. Moreover, given the time constraints to carry out this research, a quantitative approach is more suitable for collecting and analyzing large quantities of data.

#### 3.2.2.2 TIME HORIZON

Taking into consideration the time constraints to carry out this research, a cross-sectional approach was adopted. The cross-sectional design seeks to collect data from multiple cases at a single point in time to understand patterns of association (Bell, 2019). Cross-sectional designs are more popular in quantitative research as they pair well with surveys and structured interviews (Bell, 2019). Specifically, the data collection was carried out in a 4-month period, from 24 February 2025 until 18 June 2025

#### 3.2.2.3 DATA COLLECTION

This study used an online survey to collect data. The main advantage of surveys is that they have strong external validity as they can be distributed in large quantities to maximize the number of respondents; thus, ensuring a large enough sample size to possibly generalize the findings (Bell & Bryman, 2018). Moreover, surveys have a high degree of replicability because it is easy for another researcher to reuse the same survey again for future studies.

The survey was designed using LimeSurvey, which is the primary tool provided by l'Université du Québec en Outaouais. To maximize the reach of participants, the survey was available online in both French and English. The bilingual translation was reviewed and validated by the co-supervisors of this research to ensure that the concepts retained the same meaning in both languages. Participants were asked to reflect on a project that they worked on in the last two years and to keep this project in mind while answering the survey. The survey began with five demographic questions related to gender, age, education, level of project management experience, and current industry experience. Participants also answered three questions related to their selected project including type, complexity and their specific role.

Following the demographic and project questions, the participants were asked to answer 54 questions that measure individual, collective and organizational competence related to their selected project using a 7-point Likert scale: 1 - Strongly Disagree, 2 – Disagree, 3 - Slightly

Disagree, 4 – Neutral, 5 - Slightly Agree, 6 – Agree, 7 - Strongly Agree. These 54 questions were adapted from existing and validated measurement instruments found in the literature, ensuring their reliability and relevance, as described in Chapter 2. To summarize what was discussed in Chapter 2, at the individual level, competence is assessed by teamwork, personal communication and relationships and engagements. At the collective level, similar aspects are assessed for project teams including proactivity, communication, cooperation and interpersonal relationship. At the organizational level, competence is evaluated based on the organizations' ability to manage competence requirements, assess the current state of their workforce's competence, attract people with the right competences and enable competence development. Table 3-4 below summarizes the 54 survey questions, grouped by individual, collective and organizational competence. The full bilingual survey with all questions can be found in Appendix 3.

| **Individual Competence (X), Measurement Instrument Source: IPMA (2015b)** | | |
|---|---|---|
| **Construct** | **Indicator** | **Question** |
| Teamwork (TW) | TW_1 | I select the right team members to build a productive team. |
| | TW_2 | I promote cooperation and networking between team members. |
| | TW_3 | I support, facilitate and review the development of the team and its members. |
| | TW_4 | I empower teams by delegating tasks and responsibilities. |
| | TW_5 | I recognize errors to facilitate learning from mistakes. |
| Personal Communication (PC) | PC_1 | I provide clear and structured information to others and verify their understanding. |
| | PC_2 | I facilitate and promote open communication. |
| | PC_3 | I choose communication styles and channels to meet the needs of the audience, situation and management level. |
| | PC_4 | I communicate effectively with virtual teams. |
| | PC_5 | I employ humour and sense of perspective when appropriate. |
| Relationships and Engagement (RE) | RE_1 | I initiate and develop personal and professional relationships. |
| | RE_2 | I build, facilitate and contribute to social networks. |
| | RE_3 | I demonstrate empathy through listening, understanding and support. |
| | RE_4 | I show confidence and respect by encouraging others to share their opinions or concerns. |
| | RE_5 | I share my own vision and goals in order to gain the engagement and commitment of others. |
| **Collective Competence (Y), Measurement Instrument Source: Macke and Crespi (2016)** | | |
| **Construct** | **Indicator** | **Question** |
| Proactivity (PRO) | PRO_1 | Our team often finds creative ways to solve problems. |
| | PRO_2 | My colleagues often cooperate so that the team can achieve their goals. |
| | PRO_3 | Our team tries to have good relationships with other teams. |
| | PRO_4 | When I have problems, my teammates usually help me. |
| | PRO_5 | When a problem hinders our progress, team members show motivation to solve it. |
| | PRO_6 | In our team, people are interested in learning more about their colleagues. |
| | PRO_7 | My colleagues participate in team decision making with their suggestions. |
| | PRO_8 | In our team, there is a balanced distribution of tasks among members. |

| | | |
|---|---|---|
| | PRO_9 | In our team colleagues usually share their knowledge. |
| Communication (COMM) | COMM_1 | In our team, we tell colleagues if they are doing something considered unacceptable. |
| | COMM_2 | We recognize a tense situation and talk about it with team members. |
| | COMM_3 | We often discuss how to deal with everyday difficulties. |
| Cooperation (COOP) | COOP_1 | We pay attention to the moods in our team. |
| | COOP_2 | My colleagues have ways to show they care about each other. |
| | COOP_3 | Relationships in our team are based on cooperation. |
| | COOP_4 | In our team we recognize the efforts of colleagues. |
| Interpersonal Relationship (IR) | IR_1 | My colleagues understand my strengths and weaknesses. |
| | IR_2 | When I have a complaint, I feel free to talk to a colleague(s) about it. |
| | IR_3 | My colleagues encourage me to meet or exceed my personal and professional goals. |
| **Organizational Competence (Z), Measurement Instrument Source: IPMA (2016)** | | |
| **Construct** | **Indicator** | **Question** |
| People's Competence Requirements (PCR) | PCR_1 | The organization manages the qualitative people's competence requirements for all the people involved in projects, programmes and portfolios (e.g. competence model, job descriptions for all project, programme and portfolio roles). |
| | PCR_2 | The organization manages the quantitative people's competence requirements for all the people involves in projects, programmes and portfolios (e.g. HR and succession planning). |
| | PCR_3 | The organization provides standards, regulation or guidelines for defining, planning and controlling people's competence requirements. |
| | PCR_4 | The standards, regulations and guidelines are understood and applied by all project, programme, and portfolio staff and managers. |
| | PCR_5 | All project, programme and portfolio managers and staff provide feedback and suggestions for the continuous improvement of people's competence requirements and the respective standard. |
| People's Competences State (PCS) | PCS_1 | The organization analyzes the current state of the project, programme and portfolio people's competences (e.g. competence assessments, benchmarking and gap analysis). |
| | PCS_2 | The organization defines corrective action, if the requirements are not met (e.g. people's competences acquisition or development). |
| | PCS_3 | The organization provides standards, regulations or guidelines for analyzing, identifying and evaluating the state of people's competences. |
| | PCS_4 | The standards, regulations and guidelines are understood and applied. |
| | PCS_5 | All project, programme and portfolio managers and staff provide feedback concerning the state of people's competences and the respective standard. |
| People's Competences Acquisition (PCA) | PCA_1 | The organization provides standards for identifying, evaluating, selecting and assigning people (e.g. recruiting assessment centre and job assignments). |
| | PCA_2 | The organization uses available internal and external sources for the people's competences acquisition (e.g. job market, contractors and service providers). |
| | PCA_3 | The organization evaluates the suitability of people against a defined requirement before recruiting and assigning them tasks in project, programme and portfolio. |
| | PCA_4 | The standards, regulations and guidelines are understood and applied. |
| | PCA_5 | All project, programme, and portfolio managers and staff provide feedback concerning the people's competences acquisition and the respective standards. |
| People's Competences | PCD_1 | The organization provide standards for selecting, performing and evaluating the people's competences development (e.g. coaching, training and mentoring). |

| | | |
|---|---|---|
| Development (PCD) | PCD_2 | The organization uses the available internal and external providers for the people's competences development (e.g. on-the-job training, external training and certification). |
| | PCD_3 | The organization evaluates the outcomes of people's competences development. |
| | PCD_4 | The standards, regulations and guidelines are understood and applied. |
| | PCD_5 | All project, programme and portfolio managers and staff provide feedback concerning the people's competences development and the respective standards. |

Table 3-4: Summary of indicators and measurement instruments

Before launching the survey, a pretest was conducted with a small group (N=4) to validate the length, clarity and content of the survey. Minor adjustments were made as required before finalizing and publishing the survey.

The study received approval from the Research Ethics Committee of UQO (Project #2025-3440). The ethics certificate was issued on 24 February 2025 and is valid until 24 February 2026. The ethics certificate is available for reference at Appendix 4. As a Canadian Armed Forces (CAF) member, it was also necessary that I obtain approval from the Social Science Research and Review Board (SSRB) to distribute the survey within the Defence Team, which includes Department of National Defence (DND) employees and CAF members. The Defence Team actively manages a wide range of initiatives, from small-scale projects to large-scale major capital projects and portfolios. The SSRRB Certification of Ethics Clearance (2225/25N) is included at Appendix 5.

The research targeted participants who met the following inclusion criteria: 18 years of age or older, have participated in a project within the past two years, and able to read and understand either French or English.

Data collection was conducted between 24 February and 18 June 2025. The survey link was shared by the co-supervisors of this study with various organizations, communities, and platforms dedicated to project management knowledge sharing, best practices and resources. These included professional communities of practice such as PMI and LinkedIn. To encourage participation, reminder messages were posted at week one, week two and again closer to the end of the data collection period.

Within DND, the survey was specifically shared within the Aerospace Engineering community through a dedicated MS Teams channel as well as with other professional colleagues within my professional networks using email communication. The goal was to reach a diverse audience, encompassing participants with varying levels of experience and from different industries, allowing for potential comparative analysis across groups in the findings. All participants received an invitation that contained a direct link to the survey.

Overall, a total of 152 participants accessed the online survey, however only 101 participants completed the survey. 51 surveys were left incomplete. This study focuses on analyzing the data from the 101 completed surveys (N=101).

#### 3.2.2.4 DATA ANALYSIS

The data was analyzed using the Partial Least Squares-Structural Equation Modeling (PLS-SEM) technique with the SmartPLS 4 software to test all propositions and abductive working hypotheses under investigation. PLS-SEM is a suitable approach for this research for several main reasons. First, PLS-SEM is effective for explaining key constructs using antecedent constructs (Sarstedt et al., 2017). Also, PLS-SEM provides flexibility for carrying out exploratory research, especially when there is not enough data to carry out confirmatory research (Sarstedt et al., 2017). Finally, PLS-SEM is the preferred approach when latent variable scores are required for further analysis, such as the evaluation of the second order constructs within the model (Hair et al., 2011).

To support the analysis of bidirectional relationships between individual, collective and organizational competence using PLS-SEM, the conceptual model illustrated in Figure 2-7 is further divided into three sub models: sub-model 1 (Figure 3-5), sub-model (Figure 3-6), and sub-model 3 (Figure 3-7). This breakdown allows the recursive relationships to be analyzed in linear form, as recommended by (Garson, 2016). Sub-Model 1 addresses propositions P1-1 and P3-1, which propose statistically significant relationships from X -> Y and X -> Z. Sub-Model 2 addresses propositions P1-2 and P2-1, which propose statistically significant relationships from Y -> X and Y -> Z. Sub-Model 3 addresses testable propositions P2-2 and P3-2, which propose statistically significant relationships from Z -> Y and Z -> X.

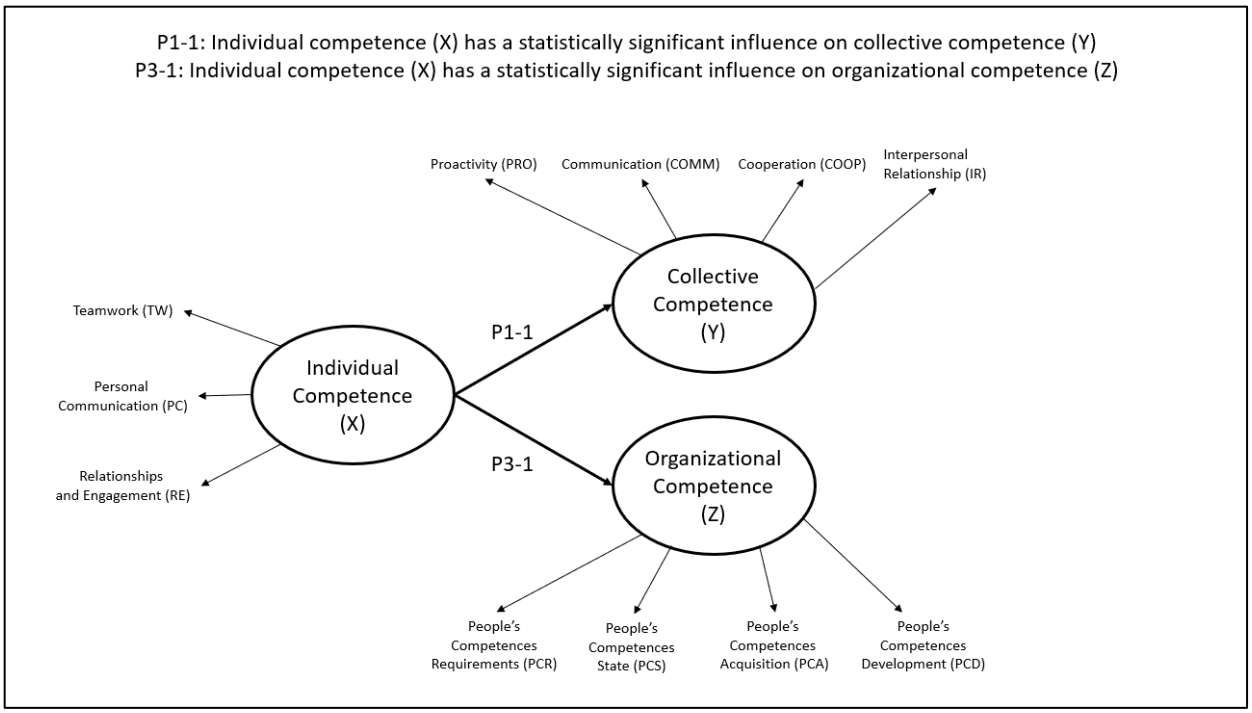



Figure 3-5: Sub-model 1 representing P1-1 and P3-1

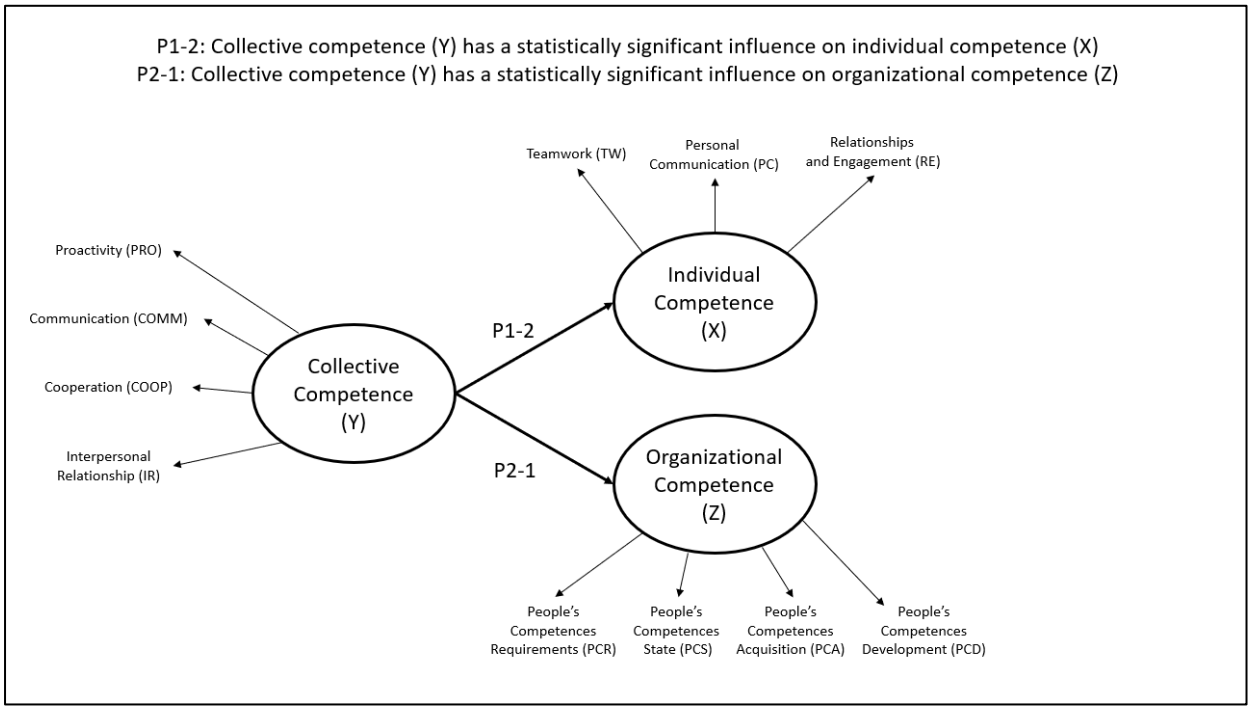



Figure 3-6: Sub-model 2 representing P1-2 and P2-1

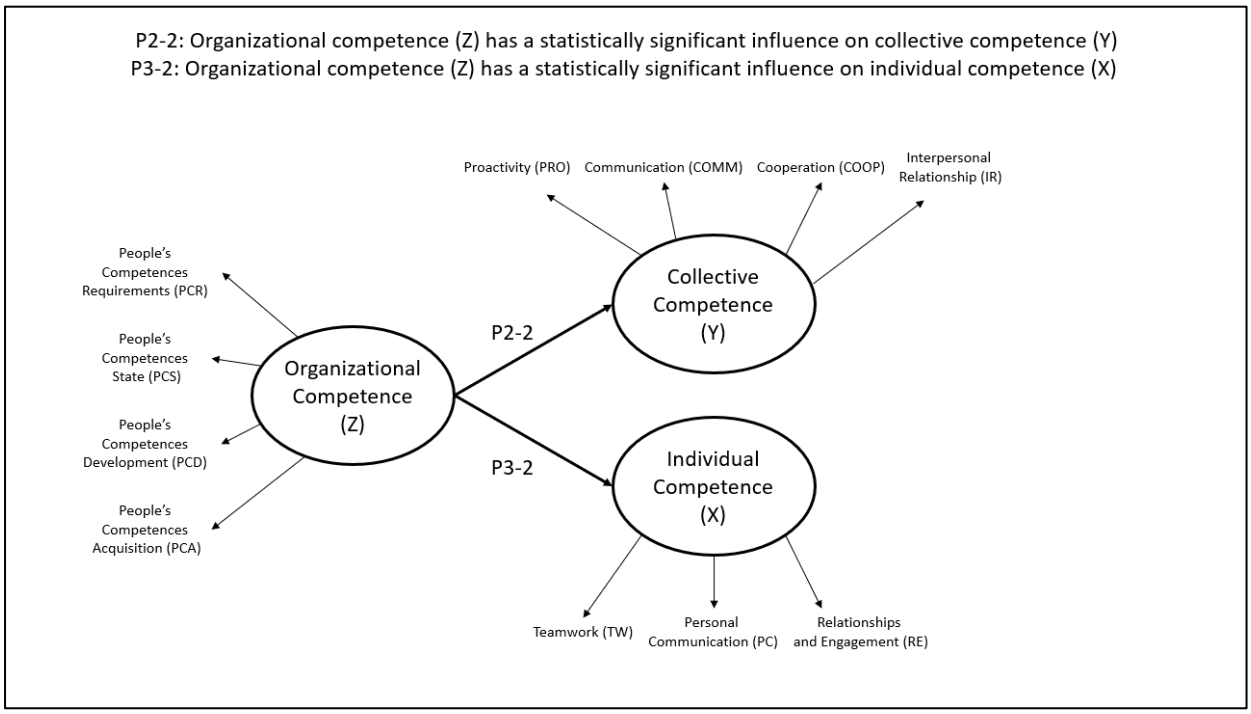



Figure 3-7: Sub-model 3 representing P2-2 and P3-2

Furthermore, the relationships between the second order constructs (individual, collective, and organizational competence) and their corresponding first order constructs (TW, PC, RE, PRO, COMM, COOP, IR, PCR, PCS, PCA, and PCD) are proposed to be reflective in nature. Reflective relationships are appropriate because survey responses are expected to be driven by participants' perceptions of competence. For instance, a participant who views themselves as a highly competent individual will likely perceive themselves to be good in areas such as teamwork, personal communication, and relationships and engagement. Since the model is based on participant's responses, and those responses are expected to stem from internal cognitive representations of the constructs, the relationships are considered reflective (Chin et al., 2008).

Generally, the minimum sample size estimated for data collection when using PLS-SEM is determined using the 10-times rule, which is described by Hair et al. (2011) as follows:

> "PLS-SEM minimum sample size should be equal to the larger of the following: (1) ten times the largest number of formative indicators used to measure one construct or (2) ten times the largest number of structural paths directed at a particular latent construct in the structural model" (p. 144).

For this study, the minimum required sample size is set at 90 participants. This is determined using the 10-times rule, where the largest number of indicators, which is nine for the proactivity dimension within collective competence (PRO1-PRO9 as summarized in Table 3-4), is multiplied by ten, resulting in a minimum sample size of 90. With 101 completed surveys, the minimum sample size was exceeded.

When analyzing data using PLS-SEM, the general rule of thumb is to start by assessing the measurement model followed by the structural model using the following three steps for the data analysis: 1. determining the relationships between constructs and observable variables, which includes re-specifying the model to remove any insignificant relationships; 2. evaluating the reliability and validity of the model; and 3. evaluating the final model (Fernandes, 2012; Sarstedt et al., 2017).

This study applies the two-stage approach to estimate the parameters of the model since the model includes second order constructs (individual competence, collective competence, and organizational competence). The two-stage approach is a common method to model higher order constructs in PLS-SEM that requires consideration of the measurement models for both the lower-order and higher-order components (Becker et al., 2012; Sarstedt et al., 2019). Table 3-5: summarizes the first order constructs and their corresponding second order constructs.

| **Second Order Constructs** | **First Order Constructs** |
|---|---|
| Individual Competence (X) | Teamwork (TW)<br>Personal Communication (PC)<br>Relationships and Engagement (RE) |
| Collective Competence (Y) | Proactivity (PRO)<br>Communication (COMM)<br>Cooperation (COOP)<br>Interpersonal Relationship (IR) |
| Organizational Competence (Z) | People's Competences Requirements (PCR)<br>People's Competences State (PCS)<br>People's Competences Acquisition (PCA)<br>People's Competences Development (PCD) |

Table 3-5: Summary of first and second order constructs

In Stage 1, the repeated indicator approach is applied, where second order constructs are assigned the same indicators as those assigned to their corresponding first order variables. During this stage, the measurement model is evaluated and refined as needed to remove any insignificant relationships. The structural model is not evaluated in this stage. Instead, the objective is to calculate the first-order latent variable scores that will later be used as indicators for the second-order constructs. As Sarstedt et al. (2019) explain, "Instead of interpreting the model estimates… researchers need to save the scores of all constructs in the model and add these as new variables to the dataset" (p. 199).

At this stage, the evaluation of the measurement model involves examining several key metrics, including the factor loadings of all indicators, composite reliability, convergent validity, (measured through Cronbach's alpha and average variance extracted), and discriminant validity (Chin, 1998; Gefen et al., 2000; Hair et al., 2011).

**Factor Loadings**

Factor loadings indicate the strength and direction of the relationship between a construct and its indicators. Higher loadings suggest a stronger association. In exploratory research, loadings should be greater than 0.6, otherwise the indicator should be removed from the model (Hair et al., 2006).

**Cronbach's Alpha**

Cronbach's alpha is used to measure evaluate convergent validity in reflective models (Garson, 2016). That is, how well a set of indicators measure the same construct. For exploratory research, Cronbach's alpha equal to or greater than 0.6 is satisfactory (Chin, 1998).

**Composite Reliability (CR)**

Composite reliability is another metric used to evaluate convergent validity and is a preferred approach over Cronbach's alpha given that the latter tends to over or underestimate reliability (Garson, 2016). For exploratory research, composite reliability equal to or greater than 0.6 is satisfactory (Chin, 1998).

### Average Variance Extracted (AVE)

Average variance extracted (AVE) is a metric that tests convergent validity (Garson, 2016; Hair et al., 2011). It is the variance captured by the construct in relation to the variance due to measurement error (Chin, 1998; Hair et al., 2011). The value of AVE should be at least equal to or greater than 0.5 so that the construct accounts for more than half of the variance observed in its indicators (Hair et al., 2011, p. 196).

### Discriminant Validity

Discriminant validity indicates how much a construct is distinct from other constructs in the model. One way of assessing discriminant validity is by applying the Fornell Larker Criterion, where the square root of AVE of each construct should be greater than the correlation coefficients between that construct and the other constructs (Hair et al., 2011).

### Variance Inflation Factor (VIF)

The variance inflation factor (VIF) assesses multicollinearity in the measurement model in formative indicators (Hair et al., 2011). A VIF that is equal to or greater than 5 indicates collinearity issues and the indicator should be removed from the model. A VIF below 5 indicates that there are no collinearity issues (Hair et al., 2011).

In Stage 2, the latent variable scores obtained from Stage 1 serve as indicators to build the measurement model for the second order constructs (Sarstedt et al., 2019). The measurement model is then evaluated and respecified as needed to remove any insignificant relationships. At this stage, the structural model is evaluated. According to Sarstedt et al. (2019) "The disjoint two-stage approach uses multi-items in the second stage, which permits the application of all structural model assessment criteria. Hence, when using the disjoint two-stage approach, researchers should assess the structural model on the grounds of stage two results" (p. 199).

At this stage, the evaluation of the measurement model requires assessing the same key metrics as in Stage 1, such as factor loadings of all indicators, composite reliability, convergent validity, and discriminant validity. Moreover, additional metrics must be considered to assess the

structural model, including the path coefficient, coefficient of determination, effect size, P-value, and T-value (Chin, 1998; Gefen et al., 2000; Hair et al., 2011).

### Path Coefficient

The path coefficient indicates the strength and direction of the relationship between two constructs. Values range from -1 to +1.

### Coefficient of Determination ($R^2$)

The coefficient of determination ($R^2$) indicates the percentage of the dependent variable that is explained by the independent variable. A value above 0.75 is considered to be substantial, a value above 0.5 is moderate and a value above 0.25 is considered weak (Hair et al., 2011).

### Effect Size ($f^2$)

The effect size ($f^2$) is the strength of the relationship between constructs (Geert van den Berg, 2024). An $f^2$ greater than 0.35 is considered to have a large effect, an $f^2$ greater than 0.15 is considered to have a medium effect and an $f^2$ greater than 0.02 is considered to have a small effect (Geert van den Berg, 2024; Kock & Hadaya, 2018).

### T-Value and P-Value

The t-values and p-values determine the statistical significance of path coefficients in a structural model (Hair et al., 2011). The t-value measures the size of the path coefficient relative to a probability error (Hair et al., 2022). The critical t-values for a two-tailed test greater than 2.57 indicates a 1% significance level, a t-value greater than 1.96 indicates a 5% significance level, and a t-value greater than 1.65 indicates a 10% significance level (Hair et al., 2022).

The p-value correspond to the t-value and indicates the probability that the path coefficient is significant, when it is not (Hair et al., 2022). A p-value less than 0.01 indicates a 1% significance level, a p-value less than 0.05 indicates a 5% significance level, and a p-value less than 0.1 indicates a 10% significance level (Hair et al., 2022).

According to Hair et al. (2022), to calculate the p-values and t-values of the model, the Consistent PLS-SEM Bootstrapping algorithm should be run using 5000 sub-samples, a two-tailed test and a significance level of 5%.

The key metrics used to evaluate the measurement model and the structural model in Stage 1 and 2 are summarized in Table 3-6 below.

| | Metric | Description | Suggested Threshold | Reference(s) |
|---|---|---|---|---|
| **Key metrics to assess the measurement model** | Factor Loadings | Estimated relationship between indicators and construct. | > 0.6 | Hair et al. (2006) |
| | Cronbach's alpha (α) | Internal consistency of test items and scale. | α > 0.6 | Garson (2016), Chin (1998) |
| | Composite Reliability (CR) | | CR > 0.6 | Garson (2016), Chin (1998) |
| | Average Variance Extracted (AVE) | Variance captured by the construct in relation to the variance due to measurement error. | AVE ≥ 0.5 | Chin (1998), Hair et al. (2011), Garson (2016) |
| | Discriminant validity (Fornell-Larker Criterion) | Confirms that the constructs are distinct concepts (unrelated). | The square root of AVE of each construct should be greater than the correlation coefficients between that construct and the other constructs. | Hair et al. (2011) |
| | Variance Inflation Factor (VIF) | Measures multicollinearity of variables. | VIF ≥ 5: collinearity issues<br><br>VIF < 5: no collinearity issues | Hair et al. (2011) |
| **Key metrics to assess the structural model** | Path Coefficient | Strength and direction of relationship between two constructs. | > -1 and < 1 | Gefen et al. (2000) |
| | Coefficient of determination ($R^2$) | The percentage of the dependent variable that is explained by the independent variable. | $R^2 \geq 0.90$: over-fit<br><br>$R^2 \geq 0.75$: substantial effect<br><br>$R^2 \geq 0.5$: moderate effect<br><br>$R^2 \geq 0.25$: weak effect | Hair et al. (2011) |
| | Effect size index ($f^2$) | Strength of the relationship between constructs. | $f^2 > 0.02$: small effect<br><br>$f^2 > 0.15$: medium effect | Geert van den Berg (2024), Kock and Hadaya (2018) |

| | Metric | Description | Suggested Threshold | Reference(s) |
|---|---|---|---|---|
| | | | $f^2 > 0.35$: large effect | |
| | T-values and P-values | Determines the statistical significance of path coefficients in a structural model | t-value > 2.58, $p < 0.01$: 1% significance level<br><br>t-value > 1.96, $p < 0.05$: 5% significance level<br><br>t-value > 1.65, $p < 0.1$: 10% significance level | (Hair et al., 2022) |

Table 3-6: Key metrics to assess the measurement model and structural model in PLS-SEM

The summary of the data analysis approach is presented in Figure 3-8 below. Note that the PLS-SEM two-stage approach to assess the model is repeated for each of the sub-models (sub-model 1, sub-model 2, and sub-model 3) to address all testable propositions and working abductive hypotheses.

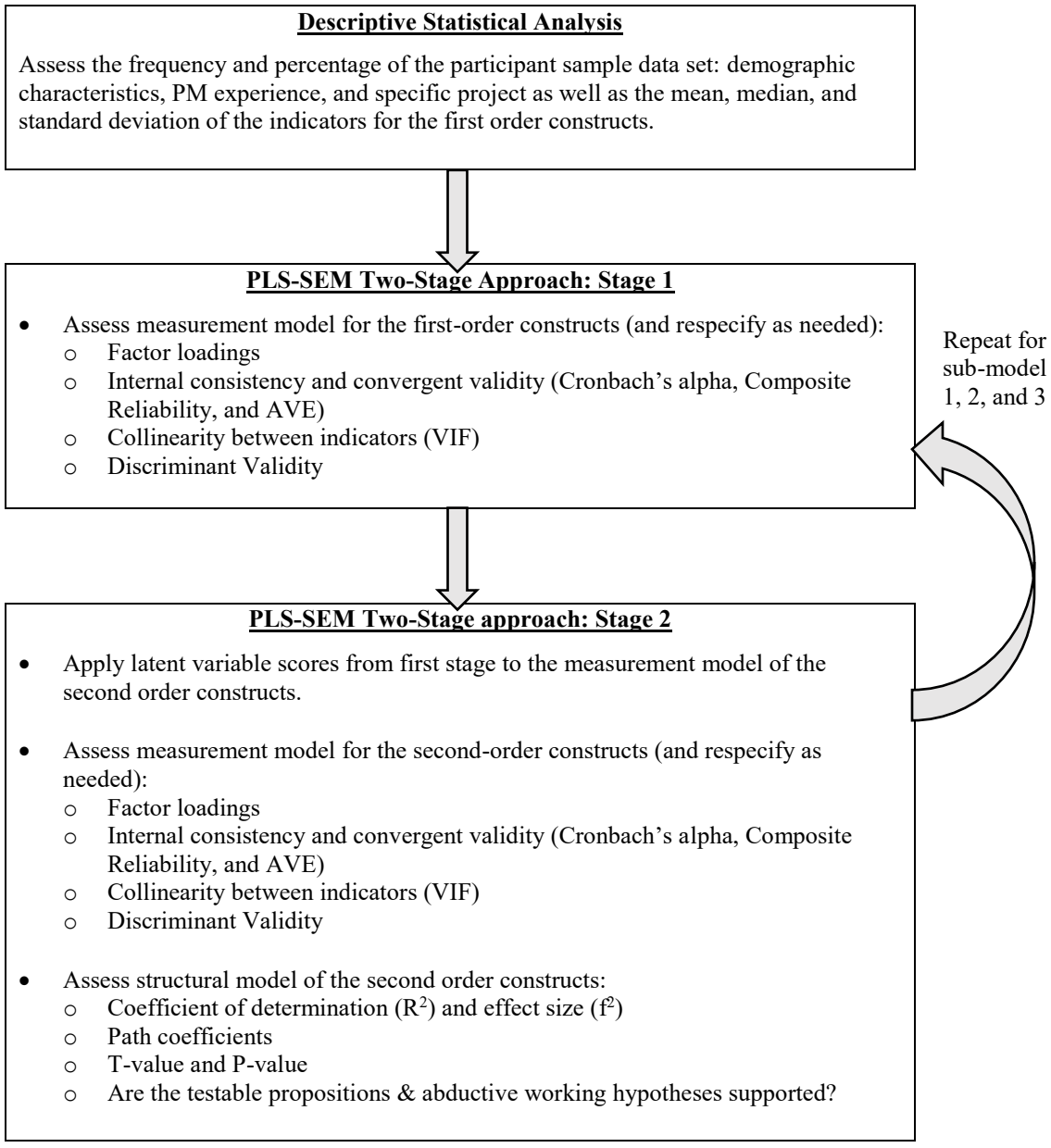



Figure 3-8: Summary of the data analysis approach

# CHAPTER 4 : RESULTS OF THE DATA ANALYSIS

This chapter presents the results from the analysis of the data collected through the survey. Section 4.1 begins with an overview of the descriptive statistical analysis. Following that, Section 4.2 presents the results of the PLS-SEM two stage approach for evaluating the each of the three sub-models (sub-model 1, sub-model 2 and sub-model 3). In Section 4.3, the significance and relevance of each of the research hypotheses are summarized. Section 4.4 provides a summary of the results of the coefficient of determination ($R^2$). Lastly, Section 4.5 concludes with a summary of the measurement of effect sizes ($f^2$).

## 4.1 RESULTS OF DESCRIPTIVE STATISTICAL ANALYSIS

Descriptive statistics were examined to provide a comprehensive overview of the demographic profile of the participants who completed the survey (N=101). The analysis included variables such as gender, age, education level, PM experience, current industry, type of project participants had worked on, the complexity of that project, and their role within the project. Specifically, frequencies and percentages were calculated to summarize these demographic characteristics. This information not only provides valuable insight into the respondents' backgrounds but also serves as a useful reference for future research opportunities, particularly when comparing different subgroups within the sample. Lastly, the mean, median, standard deviation, minimum value and maximum values of the observed variables for the first order constructs were also calculated.

### 4.1.1 PARTICIPANT SAMPLE - DEMOGRAPHIC CHARACTERISTICS

The demographic data indicated that a greater proportion of participants were male (56%) compared to female (45%). The largest age group among the respondents was 25-34 years old (30%), followed by 18-24 years old (28%), 35-44 years old (26%), 45-55 years old (11%) and those over 55 years old (11%). Regarding the highest level of education completed, most respondents held a Master's degree (54%), followed by an undergraduate degree (29%), doctoral degree or higher (7%), post-secondary diploma (6%), and high-school diploma (4%). One respondent indicated that they had not completed high school. Table 4-1 below summarizes the demographic characteristics of the participant sample.

| Factor | Variable | Frequency | Percent (%) |
|---|---|---|---|
| **Gender** | Female | 45 | 44.6 |
| | Male | 56 | 55.4 |
| | Non-Binary | 0 | 0 |
| | Other | 0 | 0 |
| | **Total** | **101** | **100** |
| **Age** | 18-24 years old | 28 | 27.7 |
| | 25-34 years old | 30 | 29.7 |
| | 35-44 years old | 26 | 25.7 |
| | 45-55 years old | 11 | 10.9 |
| | 55+ years old | 6 | 6 |
| | **Total** | **101** | **100** |
| **Education** | High school not completed | 1 | 1 |
| | High school diploma or equivalent | 4 | 4 |
| | Post-secondary diploma | 6 | 5.9 |
| | Undergraduate degree | 29 | 28.7 |
| | Master's degree | 54 | 53.5 |
| | Doctoral degree or higher | 7 | 6.9 |
| | **Total** | **101** | **100** |

Table 4-1: Demographic characteristics of participant sample

### 4.1.2 PARTICIPANT SAMPLE - PROJECT MANAGEMENT EXPERIENCE

The demographic data collected indicated that the largest group of participants identified themselves as competent practitioners (30%), followed by advanced beginners (27%), proficient practitioners (17%), novice (14%) and experts (13%). In terms of current employment, most participants reported working in either Information Technology and Software (24%) and Government and Public Sector (24%). This distribution reflects the survey dissemination approach, which targeted the Defence Team and leveraged professional networks that included IT professionals. Some members of Canadian Armed Forces may have identified themselves in the Government and Public Sector category, while some selected other (7%), to more precisely describe their military background. The Education and Training sector was the third most represented industry, accounting for 17% of the sample. This may be attributed to the involvement of the research co-supervisors who also helped to share the survey through their LinkedIn networks, which likely included many professionals from the education field. Collectively, all the other industries accounted for less than 30% of the reported employment sectors. Table 4-2 below summarizes the project management experience and current industry of the participant sample.

| Factor | Variable | Frequency | Percent (%) |
|---|---|---|---|
| **PM Experience** | Novice | 14 | 13.9 |
| | Advanced Beginner | 27 | 26.7 |
| | Competent Practitioner | 30 | 29.7 |
| | Proficient Practitioner | 17 | 16.8 |
| | Expert | 13 | 12.9 |
| | **Total** | **101** | **100** |
| **Current Industry** | Healthcare and Life Sciences | 7 | 6.9 |
| | Information Technology and Software | 24 | 23.7 |
| | Education and Training | 17 | 16.8 |
| | Construction and Engineering | 3 | 3 |
| | Manufacturing and Industrial Production | 3 | 3 |
| | Retail and Consumer Goods | 5 | 5 |
| | Financial Services and Banking | 4 | 4 |
| | Energy and Utilities | 3 | 3 |
| | Non-Profit and Social Services | 2 | 2 |
| | Transportation and Logisitics | 0 | 0 |
| | Government and Public Sector | 24 | 23.7 |
| | Environmental and Sustainability Services | 2 | 2 |
| | Other | 7 | 6.9 |
| | **Total** | **101** | **100** |

Table 4-2: Project management experience and current industry of participant sample

### 4.1.3 PARTICIPANT SAMPLE – SELECTION OF SPECIFIC PROJECT

Participants were asked to select a project that they had worked on within the past two years to use as a reference when responding to the survey. The most frequently selected project type was computer software development (27%), followed by equipment or system installation (14%), new product development (12%), administrative (11%), research (9%), design of plans (8%), other (8%), event or relocation (7%), maintenance of process industries (3%), and construction (2%). In terms of project complexity, the majority of respondents categorized their project as having medium complexity (59%), followed by high complexity (32%) and low complexity (10%). Regarding their role in the selected project, most respondents identified as a project team member (41%), project manager (29%), project director (19%), other (7%), project sponsor (5%). Table 4-3 summarizes the specific project information selected by the participants.

| Factor | Variable | Frequency | Percent (%) |
|---|---|---|---|
| **Type of Project** | Administrative | 11 | 10.9 |
| | Construction | 2 | 2 |
| | Computer Software Development | 27 | 26.7 |
| | Design of Plans | 8 | 7.9 |
| | Maintenance of Process Industries | 3 | 3 |
| | Event or Relocation | 7 | 6.9 |
| | Equipment or System Installation | 14 | 13.9 |
| | New Product Development | 12 | 11.9 |
| | Research | 9 | 8.9 |
| | Other | 8 | 7.9 |
| | **Total** | **101** | **100** |
| **Project Complexity** | Low | 10 | 9.9 |
| | Medium | 59 | 58.4 |
| | High | 32 | 31.7 |
| | **Total** | **101** | **100** |
| **Role** | Project Sponsor | 5 | 5 |
| | Project Director | 19 | 18.8 |
| | Project Manager | 29 | 28.7 |
| | Project Team Member | 41 | 40.6 |
| | Other | 7 | 6.9 |
| | **Total** | **101** | **100** |

Table 4-3: Specific project of participant sample

### 4.1.4 SURVEY RESPONSES (INDICATORS) - MEAN, MEDIAN & STANDARD DEVIATION

The statistical analysis of the indicators of the first order constructs revealed generally high mean and median scores. For the Teamwork (TW) indicators (TW_1 to TW_5), all mean scores exceeded 5. The median score for each indicator was 6, except for TW_3 that had a median of 5. The mean scores for all five Personal Communication (PC) indicators (PC_1 to PC_5) were above 5 and the median score for each was 6. The mean score for the Relationships and Engagement (RE) indicators (RE_1 to RE_5) was above 5, except for RE_2 that was above 4. The median score was above 6 for all indicators except RE_2 that was above 5.

The Proactivity (PRO) indicators (PRO_1 to PRO_9), all had mean scores above 5 except PRO_6 that had a mean score above 4. The median score for most was 6 except for PRO_6 and PRO_8, which was 5. For the Communication (COMM) indicators (COMM_1 to COMM_3), COMM_1 and COMM_2 had mean scores above 5, while COMM_3 was above 4 and all three indicators had median scores of 5. For the Cooperation (COOP) indicators (COOP_1 to COOP_4), each had mean scores above 5 and medians score of 6, except for COOP_1 and COOP_3 that had

median scores of 5. For Interpersonal Relationship (IR), IR_1, IR_2 and IR_3 all had mean scores above 5. IR_1 and IR_3 had median scores of 5 and IR_2 had a median score of 6.

Lastly, the indicators for the four constructs related to organizational competence, People's Competences Requirements (PCR_1 to PCR_5), People's Competences State (PCS_1 to PCS_5), People's Competences Acquisition (PCA_1 to PCA_5), and People's Competences Development (PCD_1 to PCD_5), all had a mean score above 4 and a median score of 5, except for PCR_2 that had a median score of 4.

A detailed summary of the descriptive statistics, including mean, median, standard deviation, observed minimum and observed maximum values for all indicators, is presented in Table 4-4 below.

| First Order Construct | Indicator | Mean | Median | Standard Deviation | Observed Minimum | Observed Maximum |
|---|---|---|---|---|---|---|
| **Teamwork (TW)** | TW_1 | 5.248 | 6 | 1.531 | 1 | 7 |
| | TW_2 | 5.545 | 6 | 1.375 | 1 | 7 |
| | TW_3 | 5.109 | 5 | 1.289 | 1 | 7 |
| | TW_4 | 5.307 | 6 | 1.447 | 1 | 7 |
| | TW_5 | 5.604 | 6 | 1.343 | 1 | 7 |
| **Personal Communication (PC)** | PC_1 | 5.564 | 6 | 1.353 | 1 | 7 |
| | PC_2 | 5.584 | 6 | 1.344 | 1 | 7 |
| | PC_3 | 5.475 | 6 | 1.354 | 1 | 7 |
| | PC_4 | 5.535 | 6 | 1.309 | 1 | 7 |
| | PC_5 | 5.525 | 6 | 1.376 | 1 | 7 |
| **Relationships and Engagements (RE)** | RE_1 | 5.267 | 6 | 1.364 | 1 | 7 |
| | RE_2 | 4.505 | 5 | 1.596 | 1 | 7 |
| | RE_3 | 5.525 | 6 | 1.317 | 1 | 7 |
| | RE_4 | 5.614 | 6 | 1.251 | 1 | 7 |
| | RE_5 | 5.624 | 6 | 1.281 | 1 | 7 |
| **Proactivity (PRO)** | PRO_1 | 5.386 | 6 | 1.258 | 1 | 7 |
| | PRO_2 | 5.604 | 6 | 1.259 | 1 | 7 |
| | PRO_3 | 5.663 | 6 | 1.205 | 1 | 7 |
| | PRO_4 | 5.574 | 6 | 1.18 | 1 | 7 |
| | PRO_5 | 5.525 | 6 | 1.191 | 1 | 7 |
| | PRO_6 | 4.941 | 5 | 1.441 | 1 | 7 |
| | PRO_7 | 5.297 | 6 | 1.239 | 1 | 7 |
| | PRO_8 | 5.04 | 5 | 1.342 | 1 | 7 |
| | PRO_9 | 5.554 | 6 | 1.293 | 1 | 7 |
| **Communication (COMM)** | COMM_1 | 5.02 | 5 | 1.393 | 1 | 7 |
| | COMM_2 | 5.099 | 5 | 1.27 | 1 | 7 |
| | COMM_3 | 4.931 | 5 | 1.373 | 1 | 7 |
| **Cooperation (COOP)** | COOP_1 | 5.05 | 5 | 1.381 | 1 | 7 |
| | COOP_2 | 5.218 | 6 | 1.317 | 1 | 7 |
| | COOP_3 | 5.218 | 5 | 1.287 | 1 | 7 |
| | COOP_4 | 5.406 | 6 | 1.283 | 1 | 7 |

| First Order Construct | Indicator | Mean | Median | Standard Deviation | Observed Minimum | Observed Maximum |
|---|---|---|---|---|---|---|
| **Interpersonal Relationship (IR)** | IR_1 | 5.188 | 5 | 1.241 | 1 | 7 |
| | IR_2 | 5.307 | 6 | 1.34 | 1 | 7 |
| | IR_3 | 5.267 | 5 | 1.226 | 1 | 7 |
| **People's Competences Requirements (PCR)** | PCR_1 | 4.396 | 5 | 1.496 | 1 | 7 |
| | PCR_2 | 4.406 | 4 | 1.45 | 1 | 7 |
| | PCR_3 | 4.822 | 5 | 1.531 | 1 | 7 |
| | PCR_4 | 4.604 | 5 | 1.47 | 1 | 7 |
| | PCR_5 | 4.574 | 5 | 1.458 | 1 | 7 |
| **People's Competences State (PCS)** | PCS_1 | 4.634 | 5 | 1.412 | 1 | 7 |
| | PCS_2 | 4.673 | 5 | 1.394 | 1 | 7 |
| | PCS_3 | 4.792 | 5 | 1.444 | 1 | 7 |
| | PCS_4 | 4.703 | 5 | 1.383 | 1 | 7 |
| | PCS_5 | 4.634 | 5 | 1.461 | 1 | 7 |
| **People's Competences Acquisition (PCA)** | PCA_1 | 4.703 | 5 | 1.425 | 1 | 7 |
| | PCA_2 | 4.772 | 5 | 1.462 | 1 | 7 |
| | PCA_3 | 4.842 | 5 | 1.461 | 1 | 7 |
| | PCA_4 | 4.941 | 5 | 1.508 | 1 | 7 |
| | PCA_5 | 4.703 | 5 | 1.551 | 1 | 7 |
| **People's Competences Development (PCD)** | PCD_1 | 4.653 | 5 | 1.582 | 1 | 7 |
| | PCD_2 | 4.812 | 5 | 1.533 | 1 | 7 |
| | PCD_3 | 4.634 | 5 | 1.572 | 1 | 7 |
| | PCD_4 | 4.644 | 5 | 1.519 | 1 | 7 |
| | PCD_5 | 4.644 | 5 | 1.425 | 1 | 7 |

Table 4-4: Mean, median, and standard deviation of indicators

## 4.2 RESULTS OF THE PLS-SEM TWO-STAGE APPROACH

This section outlines the application of the two-stage Partial Least Squares Structural Equation Modeling (PLS-SEM) approach across the three sub-models. For each sub-model, Stage 1 involves evaluating the measurement model of the first-order constructs, with model respecification conducted as necessary. In Stage 2, the focus shifts to assessing the measurement model of the second-order constructs, again with respecification as required, followed by an evaluation of the structural model.

### 4.2.1 SUB-MODEL 1: STAGE 1 OF THE PLS-SEM TWO-STAGE APPROACH

**Assessing the Measurement Model of First Order Constructs**

The model was run using the Consistent PLS-SEM algorithm to calculate the key metrics required for the evaluating the measurement model. After the initial run, RE_2 had a factor loading of 0.509, which fell below the acceptable threshold of 0.6, so it was removed from the model.

After the second run, all remaining indicators had factor loadings above 0.6. However, PCS_4 and PCA_4 showed VIF values of 5.069 and 5.762 respectively. Since these exceeded the recommended threshold of 5, both indicators were removed from the model. After the third run, PCD_4 and PRO_4 were found to have VIF values of 5.025 and 5.407 respectively; thus, they were removed. After these adjustments, the model was run a fourth time and this time all key metrics, including factor loadings, Cronbach's alpha, composite reliability, AVE and VIF values met or exceeded the recommended thresholds. A detailed summary of these metrics is presented in Table 4-5 below.

For the first order constructs of individual competence, the standardized factor loadings for Teamwork ranged from 0.671 (TW_1) to 0.852 (TW_5), with t-values between 7.253 (TW_1) to 24.655 (TW_5). For Personal Communication, the factor loadings varied from 0.720 (PC_5) to 0.816 (PC_2) and t-values ranged from 9.973 (PC_5) to 21.574 (PC_2). For Relationships and Engagement, the factor loadings ranged from 0.726 (RE_5) to 0.753 (RE_1) and t-values ranged from 9.065 (RE_5) to 13.559 (RE_1).

For the first order constructs of collective competence, Proactivity had factor loadings that ranged from 0.629 (PRO_8) to 0.805 (PRO_9), with t-values ranging from 7.756 (PRO_5) to 17.741 (PRO_7). For Communication, the factor loadings ranged from 0.716 (COMM_1) to 0.769 (COMM_2) and t-values ranged from 8.536 (COMM_1) to 13.209 (COMM_3). For Cooperation, the factor loadings ranged from 0.746 (COOP_2) to 0.830 (COOP_4) and the t-values ranged from 12.594 (COOP_2) to 22.111 (COOP_1). For Interpersonal Relationship, the factor loadings ranged from 0.744 (IR_2) to 0.846 (IR_1) and the t-values ranged from 11.645 (IR_2) to 22.945 (IR_1).

For the first order constructs of organizational competence, People's Competences Requirements had factor loadings ranging from 0.750 (PCR_1) to 0.844 (PCR_5) and t-values ranging from 15.096 (PCR_1) to 21.933 (PCR_3). For People's Competences State, the factor loadings ranged from 0.742 (PCS_5) to 0.852 (PCS_2) and t-values ranged from 10.156 (PCS_5) to 23.265 (PCS_3). For People's Competences Acquisition, the factor loadings ranged from 0.694 (PCA_3) to 0.813 (PCA_1) and t-values ranged from 9.876 (PCA_3) to 19.457 (PCA_1). For

People's Competences Development, the factor loadings ranged from 0.783 (PCD_1) to 0.832 (PCD_3) and the t-values ranged from 12.266 (PCD_5) to 17.645 (PCD_3).

| First order construct | Indicator | Factor Loading (>0.6) | Cronbach's alpha (>0.6) | CR (>0.6) | AVE (> 0.5) | VIF (< 5) | Comment |
|---|---|---|---|---|---|---|---|
| **TW** | | | 0.867 | 0.874 | 0.570 | | |
| | TW_1 | 0.675 | | | | 1.886 | |
| | TW_2 | 0.810 | | | | 2.783 | |
| | TW_3 | 0.702 | | | | 1.684 | |
| | TW_4 | 0.720 | | | | 2.023 | |
| | TW_5 | 0.852 | | | | 3.673 | |
| **PC** | | | 0.878 | 0.880 | 0.592 | | |
| | PC_1 | 0.775 | | | | 2.420 | |
| | PC_2 | 0.816 | | | | 2.951 | |
| | PC_3 | 0.788 | | | | 3.301 | |
| | PC_4 | 0.745 | | | | 1.995 | |
| | PC_5 | 0.720 | | | | 2.183 | |
| **RE** | | | 0.828 | 0.829 | 0.548 | | |
| | RE_1 | 0.753 | | | | 2.678 | |
| | ~~RE_2~~ | ~~0.509~~ | | | | ~~1.880~~ | REMOVED |
| | RE_3 | 0.749 | | | | 2.415 | |
| | RE_4 | 0.732 | | | | 2.904 | |
| | RE_5 | 0.726 | | | | 1.577 | |
| **PRO** | | | 0.919 | 0.923 | 0.562 | | |
| | PRO_1 | 0.729 | | | | 2.811 | |
| | PRO_2 | 0.766 | | | | 3.209 | |
| | PRO_3 | 0.774 | | | | 3.009 | |
| | ~~PRO_4~~ | ~~0.831~~ | | | | ~~5.407~~ | REMOVED |
| | PRO_5 | 0.701 | | | | 2.658 | |
| | PRO_6 | 0.685 | | | | 2.366 | |
| | PRO_7 | 0.804 | | | | 3.235 | |
| | PRO_8 | 0.629 | | | | 1.662 | |
| | PRO_9 | 0.805 | | | | 3.333 | |
| **COMM** | | | 0.789 | 0.790 | 0.556 | | |
| | COMM_1 | 0.716 | | | | 1.809 | |
| | COMM_2 | 0.769 | | | | 2.050 | |
| | COMM_3 | 0.750 | | | | 1.464 | |
| **COOP** | | | 0.873 | 0.875 | 0.633 | | |
| | COOP_1 | 0.823 | | | | 2.371 | |
| | COOP_2 | 0.746 | | | | 2.587 | |
| | COOP_3 | 0.780 | | | | 2.048 | |
| | COOP_4 | 0.830 | | | | 3.379 | |
| **IR** | | | 0.837 | 0.842 | 0.635 | | |
| | IR_1 | 0.846 | | | | 3.796 | |
| | IR_2 | 0.744 | | | | 2.099 | |
| | IR_3 | 0.798 | | | | 1.771 | |
| **PCR** | | | 0.895 | 0.896 | 0.631 | | |
| | PCR_1 | 0.750 | | | | 2.204 | |
| | PCR_2 | 0.793 | | | | 2.114 | |
| | PCR_3 | 0.800 | | | | 3.533 | |
| | PCR_4 | 0.782 | | | | 3.744 | |

| First order construct | Indicator | Factor Loading (>0.6) | Cronbach's alpha (>0.6) | CR (>0.6) | AVE (> 0.5) | VIF (< 5) | Comment |
|---|---|---|---|---|---|---|---|
| | PCR_5 | 0.844 | | | | 2.997 | |
| **PCS** | | | 0.906 | 0.910 | 0.662 | | |
| | PCS_1 | 0.799 | | | | 2.934 | |
| | PCS_2 | 0.852 | | | | 3.857 | |
| | PCS_3 | 0.836 | | | | 3.269 | |
| | ~~PCS_4~~ | ~~0.867~~ | | | | ~~5.069~~ | REMOVED |
| | PCS_5 | 0.742 | | | | 2.606 | |
| **PCA** | | | 0.878 | 0.885 | 0.596 | | |
| | PCA_1 | 0.813 | | | | 2.995 | |
| | PCA_2 | 0.736 | | | | 1.797 | |
| | PCA_3 | 0.694 | | | | 1.931 | |
| | ~~PCA_4~~ | ~~0.865~~ | | | | ~~5.762~~ | REMOVED |
| | PCA_5 | 0.735 | | | | 1.549 | |
| **PCD** | | | 0.918 | 0.922 | 0.692 | | |
| | PCD_1 | 0.783 | | | | 4.577 | |
| | PCD_2 | 0.797 | | | | 2.743 | |
| | PCD_3 | 0.832 | | | | 2.559 | |
| | ~~PCD_4~~ | ~~0.934~~ | | | | ~~5.025~~ | REMOVED |
| | PCD_5 | 0.804 | | | | 1.870 | |

Table 4-5: Sub-model 1 (Stage 1): Key metric values for assessment of measurement model

Lastly, discriminant validity for each of the first order constructs in sub-model 1 was assessed using the Fornell-Larcker Criterion. Given that the measurement model of the lower-order constructs (TW, PC, RE, PRO, COMM, COOP, IR, PCR, PCS, PCA, PCD) are repeated in their respective higher-order constructs (Individual Competence (X), Collective Competence (Y) and Organizational Competence (Z)), it is noted by Sarsedt et al. (2019) that these types of relationships inherently violate discriminant validity, which is expected between these constructs. As such, discriminant validity between lower and higher order constructs should not be considered. Nevertheless, the results revealed that several constructs did not meet the threshold for discriminant validity, indicating potential issues with the distinctiveness between the constructs. This should be acknowledged as a limitation of this study. Table 4-6 presents the results of the Fornell-Larcker Criterion, highlighting in red the values where the square root of the AVE for a construct is not greater than the correlation coefficients between that construct and another construct.

| | TW | PC | RE | PRO | COMM | COOP | IR | PCR | PCS | PCA | PCD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **TW** | 0.755 | | | | | | | | | | |
| **PC** | 0.895 | 0.770 | | | | | | | | | |
| **RE** | 0.938 | 0.927 | 0.740 | | | | | | | | |
| **PRO** | 0.842 | 0.807 | 0.840 | 0.735 | | | | | | | |
| **COMM** | 0.782 | 0.669 | 0.733 | 0.911 | 0.745 | | | | | | |
| **COOP** | 0.801 | 0.719 | 0.802 | 0.885 | 0.910 | 0.795 | | | | | |
| **IR** | 0.692 | 0.588 | 0.702 | 0.803 | 0.805 | 0.906 | 0.797 | | | | |
| **PCR** | 0.414 | 0.447 | 0.469 | 0.549 | 0.581 | 0.478 | 0.491 | 0.794 | | | |
| **PCS** | 0.388 | 0.423 | 0.408 | 0.468 | 0.465 | 0.366 | 0.430 | 0.889 | 0.808 | | |
| **PCA** | 0.483 | 0.507 | 0.572 | 0.617 | 0.581 | 0.541 | 0.592 | 0.856 | 0.864 | 0.746 | |
| **PCD** | 0.398 | 0.499 | 0.441 | 0.479 | 0.489 | 0.422 | 0.409 | 0.768 | 0.732 | 0.717 | 0.820 |

Table 4-6: Sub-model 1 (Stage 1): Discriminant validity

### 4.2.2 SUB-MODEL 1: STAGE 2 OF THE PLS-SEM TWO-STAGE APPROACH

**Assessing the Measurement Model of Second Order Constructs**

The model was estimated using the latent variable scores obtained from Stage 1 and was run using the Consistent PLS-SEM algorithm. All the factor loadings, Cronbach's alpha, composite reliability, AVE and VIF values met or exceeded the recommended thresholds. A detailed summary of these metrics is presented in Table 4-7 below. Furthermore, the Consistent PLS-SEM Bootstrapping algorithm was conducted using 5000 sub-samples, a two-tailed test and a significance level of 5. The analysis revealed statistically significant relationships between the first order constructs and second order constructs (t-value > 1.96). Table 4-7 presents the corresponding t-values and Figure 4-1 illustrates the factor loadings with the t-values shown in brackets.

| Second order constructs | First order constructs | Factor Loading (>0.6) | T Value (>1.96) | Cronbach's alpha (>0.6) | CR (>0.6) | AVE (> 0.5) | VIF (< 5) |
|---|---|---|---|---|---|---|---|
| **Individual Competence (X)** | | | | 0.920 | 0.930 | 0.746 | |
| | TW | 0.904 | 22.196 | | | | 3.329 |
| | PC | 0.865 | 15.148 | | | | 3.238 |
| | RE | 0.901 | 25.858 | | | | 3.432 |
| **Collective Competence (Y)** | | | | 0.919 | 0.920 | 0.792 | |
| | PRO | 0.981 | 22.542 | | | | 3.354 |
| | COMM | 0.804 | 13.213 | | | | 2.898 |
| | COOP | 0.899 | 22.285 | | | | 3.934 |
| | IR | 0.754 | 10.035 | | | | 2.687 |
| **Organizational Competence (Z)** | | | | 0.905 | 0.910 | 0.704 | |
| | PCR | 0.827 | 11.017 | | | | 3.426 |
| | PCS | 0.752 | 7.198 | | | | 3.233 |
| | PCA | 0.938 | 11.196 | | | | 2.649 |
| | PCD | 0.829 | 8.400 | | | | 2.053 |

Table 4-7: Sub-model 1 (Stage 2): Key metric values for assessment of measurement model

The discriminant validity for each of the second order constructs in sub-model 1 was assessed using the Fornell-Larcker Criterion. The results revealed that all the constructs met the threshold for discriminant validity, indicating no issues with the distinctiveness between the constructs. Table 4-8 presents the results of the Fornell-Larcker Criterion.

| | Collective Competence (Y) | Individual Competence (X) | Organizational Competence (Z) |
|---|---|---|---|
| **Collective Competence (Y)** | 0.864 | | |
| **Individual Competence (X)** | 0.840 | 0.890 | |
| **Organizational Competence (Z)** | 0.594 | 0.529 | 0.839 |

Table 4-8: Sub-model 1 (Stage 2): Discriminant validity

**Assessing the Structural Model of Second Order Constructs**

The coefficient of determination ($R^2$) and effect size index ($f^2$) were also calculated, and the results are presented in Table 4-9 below. The $R^2$ for Collective Competence was 0.705, indicating that individual competence accounts for 70.5% of the variance in collective competence.

This represents a moderate effect as it exceeds the 0.25 threshold but is below the threshold of 0.75. The $R^2$ for collective competence was 0.280, suggesting that individual competence explains 28% of the variance in organizational competence. This is also considered a moderate effect based on the same threshold criteria.

Regarding effect size, the $f^2$ for collective competence was 2.395, indicating a very large effect as it significantly exceeds the threshold of 0.35. This suggests that individual competence has a dominant influence on collective competence within the model. The $f^2$ for organizational competence was 0.388, which also reflects a large effect, further supporting the strong predictive role of individual competence in explaining both collective and organizational competence.

| | **Coefficient of determination ($R^2$)** | | **Effect size ($f^2$)** | |
|---|---|---|---|---|
| **Collective Competence (Y)** | 0.705 | Moderate effect | 2.395 | Large effect |
| **Organizational Competence (Z)** | 0.280 | Moderate effect | 0.388 | Large effect |

Table 4-9: Sub-model 1 (Stage 2): Coefficient of determination ($R^2$) and effect size ($f^2$)

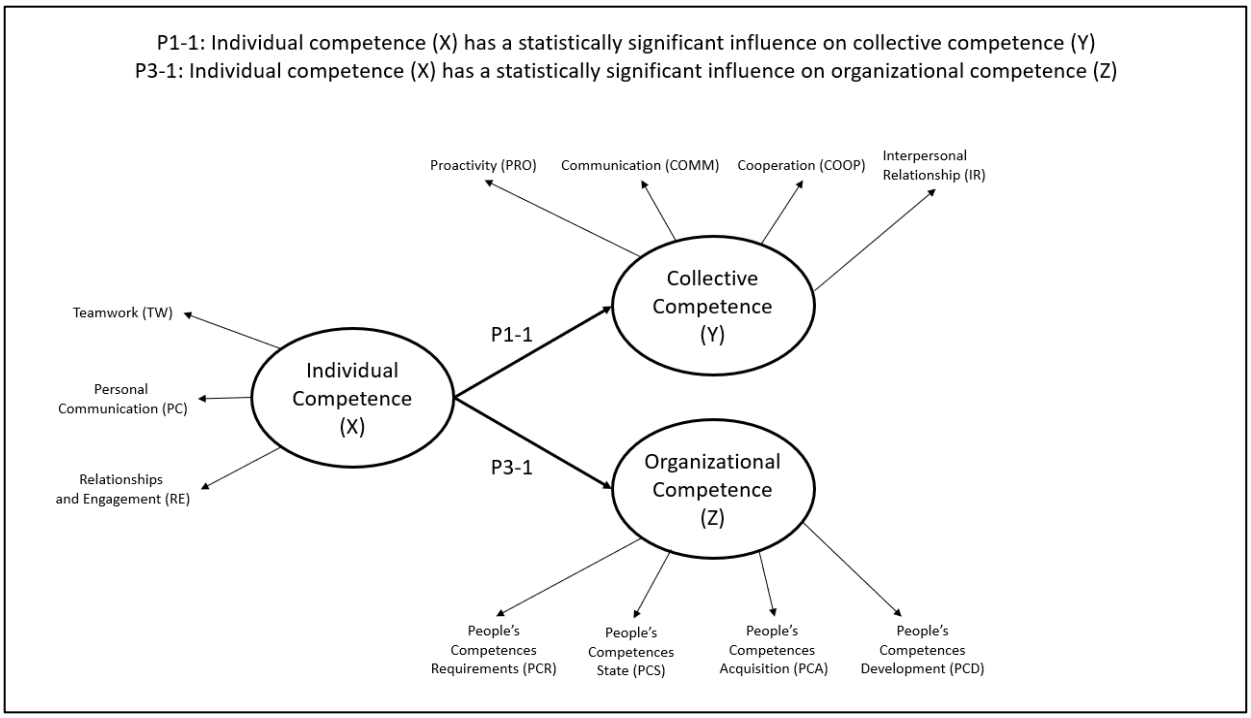
**Assessing the Testable Propositions and Abductive Working Hypotheses**

To calculate the p-values and t-values of the model, the Consistent PLS-SEM Bootstrapping algorithm was applied using 5000 sub-samples, a two-tailed test and a significance level of 5%. The use of 5000 sub-samples aligns with the recommendations by Hair et al. (2022). The p-values for the relationships between X -> Y and X -> Z were both 0.000, and the corresponding t-values exceeded 2.58, indicating statistical significance at the 1% level. Figure 4-1 illustrates the factor loadings with the t-values shown in brackets. Overall, these results confirm that both relationships are statistically significant, supporting P1-1 and P3-1 and thus H1-1 and H3-1, which is presented in Table 4-10 below.

| | Relationship | Abductive Working Hypotheses | | Testable Proposition | Path Coefficients | P-value | T-Value | Conclusion |
|---|---|---|---|---|---|---|---|---|
| H1-1 | X -> Y | Individual competence (X) influences collective competence (Y) | P1-1 | Individual competence (X) has a statistically significant influence on collective competence (Y) | 0.840 | 0.000 | 16.300 | Supported |
| H3-1 | X -> Z | Individual competence (X) influences organizational competence (Z). | P3-1 | Individual competence (X) has a statistically significant influence on organizational competence (Z) | 0.529 | 0.000 | 5.279 | Supported |

Table 4-10: Sub-model 1: Abductive working hypotheses and testable propositions

Moreover, Figure 4-1 below provides a visual representation of the final model for sub-model 1 in PLS-SEM, which includes the factor loadings with the corresponding t-values shown in brackets. This figure is shown alongside the initial sub-model 1, which illustrates the testable propositions P1-1 and P3-1. By comparing both versions, it is clear that the final model supports and validates the proposed relationships.



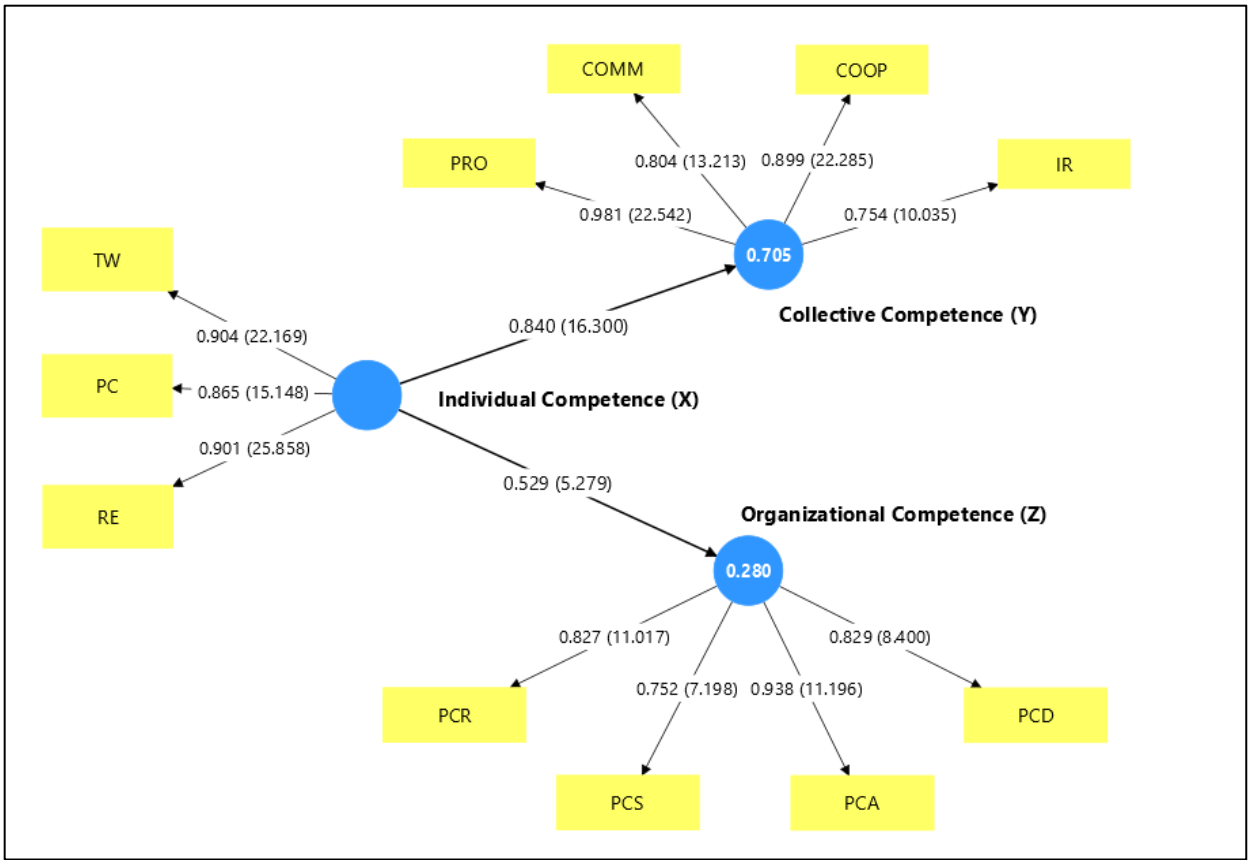




Figure 4-1: Results of sub-model 1 (P1-1 and P3-1)

### 4.2.3 SUB-MODEL 2: STAGE 1 OF THE PLS-SEM TWO-STAGE APPROACH

**Assessing the Measurement Model of First Order Constructs**

The model was run using the Consistent PLS-SEM algorithm to calculate the key metrics required for the evaluating the measurement model. After the initial run, RE_2 had a factor loading of 0.507, which fell below the acceptable threshold of 0.6, so it was removed from the model. After the second run, all remaining indicators had factor loadings above 0.6. However, PCA_4 and PCD_1, and PCD_4 showed VIF values of 5.762, 5.427, and 5.461 respectively. Since these exceeded the recommended threshold of 5, all three indicators were removed from the model. After these adjustments, the model was run a third time and this time all key metrics, including factor loadings, Cronbach's alpha, composite reliability, AVE and VIF values met or exceeded the recommended thresholds. A detailed summary of these metrics is presented in Table 4-11 below.

For the first order constructs of individual competence, the standardized factor loadings for Teamwork ranged from 0.675 (TW_1) to 0.853 (TW_5), with t-values between 7.266 (TW_1) to 24.821 (TW_5). For Personal Communication, the factor loadings varied from 0.719 (PC_5) to 0.817 (PC_2) and t-values ranged from 9.917 (PC_5) to 21.543 (PC_2). For Relationships and Engagement, the factor loadings ranged from 0.726 (RE_5) to 0.753 (RE_1) and t-values ranged from 9.018 (RE_5) to 13.568 (RE_1).

For the first order constructs of collective competence, Proactivity had factor loadings that ranged from 0.635 (PRO_8) to 0.820 (PRO_9), with t-values ranging from 7.303 (PRO_5) to 18.094 (PRO_7). For Communication, the factor loadings ranged from 0.719 (COMM_1) to 0.763 (COMM_2) and t-values ranged from 8.841 (COMM_1) to 12.877 (COMM_3). For Cooperation, the factor loadings ranged from 0.749 (COOP_2) to 0.825 (COOP_4) and the t-values ranged from 12.293 (COOP_2) to 22.325 (COOP_1). For Interpersonal Relationship, the factor loadings ranged from 0.743 (IR_2) to 0.852 (IR_1) and the t-values ranged from 11.776 (IR_2) to 23.534 (IR_1).

For the first order constructs of organizational competence, People's Competences Requirements had factor loadings ranging from 0.752 (PCR_1) to 0.843 (PCR_5) and t-values ranging from 13.750 (PCR_2) to 22.126 (PCR_3). For People's Competences State, the factor loadings ranged from 0.744 (PCS_5) to 0.847 (PCS_4) and t-values ranged from 10.464 (PCS_5)

to 25.592 (PCS_3). For People's Competences Acquisition, the factor loadings ranged from 0.709 (PCA_2) to 0.813 (PCA_1) and t-values ranged from 10.346 (PCA_5) to 20.662 (PCA_1). For People's Competences Development, the factor loadings ranged from 0.749 (PCD_1) to 0.822 (PCD_3) and the t-values ranged from 11.239 (PCD_5) to 13.716 (PCD_3).

| First order construct | Indicator | Factor Loading (>0.6) | Cronbach's alpha (>0.6) | CR (>0.6) | AVE (> 0.5) | VIF (< 5) | Comments |
|---|---|---|---|---|---|---|---|
| **TW** | | | 0.867 | 0.874 | 0.570 | | |
| | TW_1 | 0.675 | | | | 1.733 | |
| | TW_2 | 0.810 | | | | 2.300 | |
| | TW_3 | 0.701 | | | | 1.684 | |
| | TW_4 | 0.720 | | | | 2.023 | |
| | TW_5 | 0.853 | | | | 2.564 | |
| **PC** | | | 0.878 | 0.880 | 0.592 | | |
| | PC_1 | 0.775 | | | | 2.420 | |
| | PC_2 | 0.817 | | | | 2.951 | |
| | PC_3 | 0.788 | | | | 3.301 | |
| | PC_4 | 0.745 | | | | 1.995 | |
| | PC_5 | 0.719 | | | | 1.774 | |
| **RE** | | | 0.828 | 0.829 | 0.548 | | |
| | RE_1 | 0.753 | | | | 2.678 | |
| | ~~RE_2~~ | ~~0.507~~ | | | | ~~1.880~~ | REMOVED |
| | RE_3 | 0.749 | | | | 2.415 | |
| | RE_4 | 0.732 | | | | 1.638 | |
| | RE_5 | 0.726 | | | | 1.577 | |
| **PRO** | | | 0.919 | 0.923 | 0.562 | | |
| | PRO_1 | 0.732 | | | | 2.811 | |
| | PRO_2 | 0.785 | | | | 2.920 | |
| | PRO_3 | 0.788 | | | | 2.949 | |
| | PRO_4 | 0.809 | | | | 3.699 | |
| | PRO_5 | 0.669 | | | | 2.170 | |
| | PRO_6 | 0.670 | | | | 2.008 | |
| | PRO_7 | 0.811 | | | | 2.864 | |
| | PRO_8 | 0.635 | | | | 1.885 | |
| | PRO_9 | 0.820 | | | | 3.225 | |
| **COMM** | | | 0.789 | 0.790 | 0.555 | | |
| | COMM_1 | 0.719 | | | | 1.809 | |
| | COMM_2 | 0.763 | | | | 2.050 | |
| | COMM_3 | 0.753 | | | | 1.464 | |
| **COOP** | | | 0.873 | 0.874 | 0.633 | | |
| | COOP_1 | 0.824 | | | | 3.381 | |
| | COOP_2 | 0.749 | | | | 2.139 | |
| | COOP_3 | 0.782 | | | | 2.970 | |
| | COOP_4 | 0.825 | | | | 2.123 | |
| **IR** | | | 0.837 | 0.843 | 0.636 | | |
| | IR_1 | 0.852 | | | | 3.775 | |
| | IR_2 | 0.743 | | | | 2.552 | |
| | IR_3 | 0.793 | | | | 2.624 | |
| **PCR** | | | 0.895 | 0.896 | 0.631 | | |
| | PCR_1 | 0.752 | | | | 2.505 | |

| First order construct | Indicator | Factor Loading (>0.6) | Cronbach's alpha (>0.6) | CR (>0.6) | AVE (> 0.5) | VIF (< 5) | Comments |
|---|---|---|---|---|---|---|---|
| | PCR_2 | 0.774 | | | | 3.577 | |
| | PCR_3 | 0.808 | | | | 3.350 | |
| | PCR_4 | 0.792 | | | | 2.511 | |
| | PCR_5 | 0.843 | | | | 2.997 | |
| **PCS** | | | 0.906 | 0.909 | 0.662 | | |
| | PCS_1 | 0.800 | | | | 2.516 | |
| | PCS_2 | 0.834 | | | | 2.989 | |
| | PCS_3 | 0.840 | | | | 3.610 | |
| | PCS_4 | 0.847 | | | | 3.685 | |
| | PCS_5 | 0.744 | | | | 2.936 | |
| **PCA** | | | 0.832 | 0.836 | 0.556 | | |
| | PCA_1 | 0.813 | | | | 2.926 | |
| | PCA_2 | 0.709 | | | | 2.373 | |
| | PCA_3 | 0.725 | | | | 2.235 | |
| | ~~PCA_4~~ | ~~0.864~~ | | | | ~~5.762~~ | REMOVED |
| | PCA_5 | 0.732 | | | | 1.549 | |
| **PCD** | | | 0.834 | 0.836 | 0.627 | | |
| | ~~PCD_1~~ | ~~0.772~~ | | | | ~~5.427~~ | REMOVED |
| | PCD_2 | 0.749 | | | | 2.114 | |
| | PCD_3 | 0.822 | | | | 2.342 | |
| | ~~PCD_4~~ | ~~0.945~~ | | | | ~~5.641~~ | REMOVED |
| | PCD_5 | 0.801 | | | | 2.711 | |

Table 4-11: Sub-model 2 (Stage 1): Key metric values for assessment of measurement model

The discriminant validity for each of the first order constructs in sub-model 2 was assessed using the Fornell-Larcker Criterion. Similar to the results of sub-model 1, the results of sub-model 2 revealed that several constructs did not meet the threshold for discriminant validity, indicating potential issues with the distinctiveness between the constructs. This should be acknowledged as a limitation of this study. Table 4-12 presents the results of the Fornell-Larcker Criterion, highlighting in red the values where the square root of the AVE for a construct is not greater than the correlation coefficients between that construct and another construct.

| | TW | PC | RE | PRO | COMM | COOP | IR | PCR | PCS | PCA | PCD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **TW** | 0.755 | | | | | | | | | | |
| **PC** | 0.895 | 0.770 | | | | | | | | | |
| **RE** | 0.938 | 0.927 | 0.740 | | | | | | | | |
| **PRO** | 0.849 | 0.810 | 0.832 | 0.750 | | | | | | | |
| **COMM** | 0.782 | 0.669 | 0.733 | 0.908 | 0.745 | | | | | | |
| **COOP** | 0.801 | 0.719 | 0.802 | 0.884 | 0.910 | 0.795 | | | | | |
| **IR** | 0.692 | 0.588 | 0.702 | 0.788 | 0.804 | 0.906 | 0.797 | | | | |
| **PCR** | 0.414 | 0.447 | 0.469 | 0.548 | 0.581 | 0.477 | 0.491 | 0.794 | | | |
| **PCS** | 0.408 | 0.433 | 0.412 | 0.492 | 0.497 | 0.394 | 0.455 | 0.891 | 0.814 | | |
| **PCA** | 0.483 | 0.507 | 0.572 | 0.619 | 0.579 | 0.540 | 0.591 | 0.855 | 0.874 | 0.746 | |
| **PCD** | 0.382 | 0.496 | 0.411 | 0.471 | 0.504 | 0.427 | 0.424 | 0.808 | 0.804 | 0.750 | 0.792 |

Table 4-12: Sub-model 2 (Stage 1): Discriminant validity

### 4.2.4 SUB-MODEL 2: STAGE 2 OF THE PLS-SEM TWO-STAGE APPROACH

**Assessing Measurement Model of Second Order Constructs**

The model was estimated using the latent variable scores obtained from Stage 1 and was run using the Consistent PLS-SEM algorithm. All the factor loadings, Cronbach's alpha, composite reliability, AVE and VIF values met or exceeded the recommended thresholds. A detailed summary of these metrics is presented in Table 4-13 below. Furthermore, the Consistent PLS-SEM Bootstrapping algorithm was conducted using 5000 sub-samples, a two-tailed test and a significance level of 5. The analysis revealed statistically significant relationships between the first order constructs and second order constructs (t-value > 1.96). Table 4-13 presents the corresponding t-values and Figure 4-2 illustrates the factor loadings with the t-values shown in brackets.

| Second order constructs | First order constructs | Factor Loading (>0.6) | T-value (>1.96) | Cronbach's alpha (>0.6) | CR (>0.6) | AVE (> 0.5) | VIF (< 5) |
|---|---|---|---|---|---|---|---|
| **Individual Competence (X)** | | | | 0.919 | 0.922 | 0.792 | |
| | TW | 0.934 | 24.856 | | | | 3.329 |
| | PC | 0.840 | 14.533 | | | | 3.238 |
| | RE | 0.894 | 23.806 | | | | 3.431 |
| **Collective Competence (Y)** | | | | 0.920 | 0.927 | 0.792 | |
| | PRO | 0.973 | 26.817 | | | | 3.429 |
| | COMM | 0.829 | 15.822 | | | | 2.917 |
| | COOP | 0.862 | 21.659 | | | | 4.014 |
| | IR | 0.778 | 11.813 | | | | 2.660 |
| **Organizational Competence (Z)** | | | | 0.912 | 0.921 | 0.724 | |
| | PCR | 0.892 | 12.383 | | | | 3.438 |
| | PCS | 0.787 | 7.701 | | | | 3.677 |
| | PCA | 0.958 | 11.022 | | | | 2.711 |
| | PCD | 0.750 | 7.127 | | | | 2.212 |

Table 4-13: Sub-model 2 (Stage 2): Key metric values for assessment of measurement model

The discriminant validity for each of the second order constructs in sub-model 2 was assessed using the Fornell-Larcker Criterion. The results revealed that all the constructs met the threshold for discriminant validity, indicating no issues with the distinctiveness between the constructs. Table 4-14 presents the results of the Fornell-Larcker Criterion.

| | Collective Competence (Y) | Individual Competence (X) | Organizational Competence (Z) |
|---|---|---|---|
| **Collective Competence (Y)** | 0.863 | | |
| **Individual Competence (X)** | 0.842 | 0.890 | |
| **Organizational Competence (Z)** | 0.596 | 0.516 | 0.851 |

Table 4-14: Sub-model 2 (Stage 2): Discriminant validity

**Assessing Structural Model of Second Order Constructs**

The coefficient of determination ($R^2$) and effect size index ($f^2$) were also calculated, and the results are presented in Table 4-15 below. The $R^2$ for Individual Competence was 0.709, indicating that collective competence accounts for 70.9% of the variance in individual competence. This represents a moderate effect as it exceeds the 0.25 threshold but is below the threshold of 0.75. The $R^2$ for organizational competence was 0.355, suggesting that collective competence explains 35.5% of the variance in organizational competence. This is also considered a moderate effect based on the same threshold criteria.

Regarding effect size, the $f^2$ for individual competence was 2.442, indicating a very large effect as it significantly exceeds the threshold of 0.35. This suggests that collective competence has a dominant influence on individual competence within the model. The $f^2$ for organizational competence was 0.552, which also reflects a large effect, further supporting the strong predictive role of collective competence in explaining both individual and organizational competence.

| | **Coefficient of determination ($R^2$)** | | **Effect size ($f^2$)** | |
|---|---|---|---|---|
| **Individual Competence (X)** | 0.709 | Moderate effect | 2.442 | Large effect |
| **OrganizationalCompetence (Z)** | 0.355 | Moderate effect | 0.552 | Large effect |

Table 4-15: Sub-model 2 (Stage 2): Coefficient of determination ($R^2$) and effect size ($f^2$)

**Assessing Testable Propositions and Abductive Working Hypotheses**

To calculate the p-values and t-values of the model, the Consistent PLS-SEM Bootstrapping algorithm was applied using 5000 sub-samples, a two-tailed test and a significance level of 5%, as recommended by Hair et al. (2022). The p-values for the relationships between Y -> X and Y -> Z were both 0.000, and the corresponding t-values exceeded 2.58, indicating statistical significance at the 1% level. Overall, these results confirm that both relationships are statistically significant, supporting P1-2 and P2-1 and thus H1-2 and H2-1, which is presented in Table 4-16 below.

| | Relationship | Abductive Working Hypotheses | | Testable Proposition | Path Coefficients | P-value | T-Value | Conclusion |
|---|---|---|---|---|---|---|---|---|
| H1-2 | Y -> X | Collective competence (Y) influences individual competence (X) | P1-2 | Collective competence (Y) has a statistically significant influence on individual competence (X) | 0.842 | 0.000 | 16.619 | Supported |
| H2-1 | Y -> Z | Collective competence (X) influences organizational competence (Z). | P2-1 | Collective competence (Y) has a statistically significant influence on organizational competence (Z) | 0.596 | 0.000 | 5.415 | Supported |

Table 4-16: Sub-model 2: Abductive working hypotheses and testable propositions

Moreover, Figure 4-2 below provides a visual representation of the final model for sub-model 2 in PLS-SEM, which includes the factor loadings with the corresponding t-values shown in brackets. This figure is shown alongside the initial sub-model 2, which illustrates the testable propositions P1-2 and P2-1. By comparing both versions, the final model supports and validates the proposed relationships.

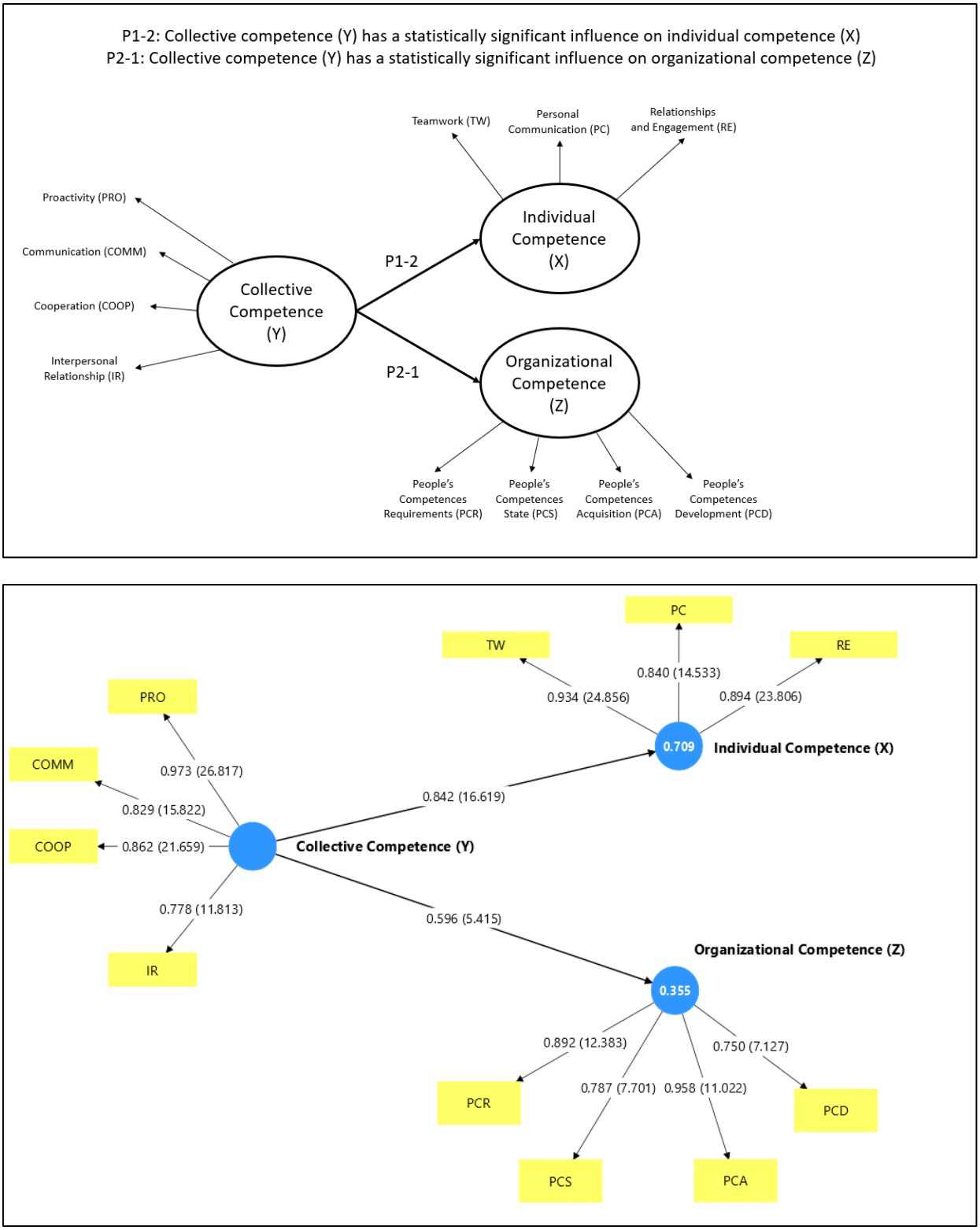



Figure 4-2: Results of sub-model 2 (P1-2 and P2-1)

### 4.2.5 SUB-MODEL 3: STAGE 1 OF THE PLS-SEM TWO-STAGE APPROACH

**Assessing Measurement Model of First Order Constructs**

The model was run using the Consistent PLS-SEM algorithm to calculate the key metrics required for the evaluating the measurement model. After the initial run, RE_2 had a factor loading of 0.507, which fell below the acceptable threshold of 0.6, so it was removed from the model. After the second run, all remaining indicators had factor loadings above 0.6. However, PCD_1 had a VIF value of 5.427, which was removed because it exceeded the recommended threshold of 5. After the third run, PCA_4 and PCD_4 had VIF values of 5.762 and 5.541, respectively. Since these exceeded the recommended threshold of 5, both indicators were removed from the model. After these adjustments, the model was run a fourth time and this time all key metrics, including factor loadings, Cronbach's alpha, composite reliability, AVE and VIF values met or exceeded the recommended thresholds. A detailed summary of these metrics is presented in Table 4-17 below.

For the first order constructs of individual competence, the standardized factor loadings for Teamwork ranged from 0.675 (TW_1) to 0.853 (TW_5), with t-values between 7.268 (TW_1) to 24.665 (TW_5). For Personal Communication, the factor loadings varied from 0.719 (PC_5) to 0.817 (PC_2) and t-values ranged from 9.874 (PC_5) to 21.911 (PC_2). For Relationships and Engagement, the factor loadings ranged from 0.726 (RE_5) to 0.753 (RE_1) and t-values ranged from 9.108 (RE_5) to 13.489 (RE_1).

For the first order constructs of collective competence, Proactivity had factor loadings that ranged from 0.631 (PRO_8) to 0.809 (PRO_9), with t-values ranging from 7.402 (PRO_5) to 18.436 (PRO_7). For Communication, the factor loadings ranged from 0.717 (COMM_1) to 0.766 (COMM_2) and t-values ranged from 8.594 (COMM_1) to 13.006 (COMM_3). For Cooperation, the factor loadings ranged from 0.747 (COOP_2) to 0.832 (COOP_4) and the t-values ranged from 12.377 (COOP_2) to 23.083 (COOP_1). For Interpersonal Relationship, the factor loadings ranged from 0.742 (IR_2) to 0.848 (IR_1) and the t-values ranged from 11.371 (IR_2) to 22.161 (IR_1).

For the first order constructs of organizational competence, People's Competences Requirements had factor loadings ranging from 0.750 (PCR_1) to 0.842 (PCR_5) and t-values ranging from 14.843 (PCR_2) to 23.120 (PCR_3). For People's Competences State, the factor

loadings ranged from 0.741 (PCS_5) to 0.856 (PCS_4) and t-values ranged from 10.372 (PCS_5) to 24.342 (PCS_3). For People's Competences Acquisition, the factor loadings ranged from 0.718 (PCA_3) to 0.811 (PCA_1) and t-values ranged from 10.130 (PCA_5) to 20.182 (PCA_1). For People's Competences Development, the factor loadings ranged from 0.774 (PCD_2) to 0.812 (PCD_3) and the t-values ranged from 11.254 (PCD_5) to 14.000 (PCD_3).

| First order construct | Indicator | Factor Loading (>0.6) | Cronbach's alpha (>0.6) | CR (>0.6) | AVE (> 0.5) | VIF (< 5) | Comment |
|---|---|---|---|---|---|---|---|
| **TW** | | | 0.867 | 0.874 | 0.570 | | |
| | TW_1 | 0.675 | | | | 1.866 | |
| | TW_2 | 0.810 | | | | 2.300 | |
| | TW_3 | 0.700 | | | | 1.684 | |
| | TW_4 | 0.720 | | | | 2.191 | |
| | TW_5 | 0.853 | | | | 2.673 | |
| **PC** | | | 0.878 | 0.880 | 0.592 | | |
| | PC_1 | 0.776 | | | | 2.103 | |
| | PC_2 | 0.817 | | | | 2.951 | |
| | PC_3 | 0.788 | | | | 3.301 | |
| | PC_4 | 0.745 | | | | 1.995 | |
| | PC_5 | 0.719 | | | | 1.774 | |
| **RE** | | | 0.828 | 0.829 | 0.548 | | |
| | RE_1 | 0.753 | | | | 2.678 | |
| | ~~RE_2~~ | ~~0.507~~ | | | | ~~1.880~~ | REMOVED |
| | RE_3 | 0.750 | | | | 2.415 | |
| | RE_4 | 0.731 | | | | 1.638 | |
| | RE_5 | 0.726 | | | | 2.097 | |
| **PRO** | | | 0.919 | 0.923 | 0.562 | | |
| | PRO_1 | 0.723 | | | | 2.811 | |
| | PRO_2 | 0.774 | | | | 3.205 | |
| | PRO_3 | 0.783 | | | | 2.398 | |
| | PRO_4 | 0.825 | | | | 3.699 | |
| | PRO_5 | 0.670 | | | | 2.170 | |
| | PRO_6 | 0.698 | | | | 2.360 | |
| | PRO_7 | 0.808 | | | | 2.932 | |
| | PRO_8 | 0.631 | | | | 1.662 | |
| | PRO_9 | 0.809 | | | | 2.415 | |
| **COMM** | | | 0.789 | 0.790 | 0.555 | | |
| | COMM_1 | 0.717 | | | | 2.664 | |
| | COMM_2 | 0.766 | | | | 2.961 | |
| | COMM_3 | 0.752 | | | | 3.128 | |
| **COOP** | | | 0.873 | 0.875 | 0.633 | | |
| | COOP_1 | 0.827 | | | | 3.795 | |
| | COOP_2 | 0.747 | | | | 2.139 | |
| | COOP_3 | 0.772 | | | | 2.148 | |
| | COOP_4 | 0.832 | | | | 3.469 | |
| **IR** | | | 0.837 | 0.842 | 0.635 | | |
| | IR_1 | 0.848 | | | | 2.709 | |
| | IR_2 | 0.742 | | | | 2.626 | |
| | IR_3 | 0.798 | | | | 2.808 | |

| First order construct | Indicator | Factor Loading (>0.6) | Cronbach's alpha (>0.6) | CR (>0.6) | AVE (> 0.5) | VIF (< 5) | Comment |
|---|---|---|---|---|---|---|---|
| **PCR** | | | 0.895 | 0.896 | 0.631 | | |
| | PCR_1 | 0.750 | | | | 2.204 | |
| | PCR_2 | 0.779 | | | | 2.114 | |
| | PCR_3 | 0.810 | | | | 2.380 | |
| | PCR_4 | 0.787 | | | | 3.488 | |
| | PCR_5 | 0.842 | | | | 3.915 | |
| **PCS** | | | 0.906 | 0.909 | 0.662 | | |
| | PCS_1 | 0.792 | | | | 2.956 | |
| | PCS_2 | 0.838 | | | | 3.861 | |
| | PCS_3 | 0.836 | | | | 3.610 | |
| | PCS_4 | 0.856 | | | | 2.882 | |
| | PCS_5 | 0.741 | | | | 2.080 | |
| **PCA** | | | 0.832 | 0.836 | 0.556 | | |
| | PCA_1 | 0.811 | | | | 2.230 | |
| | PCA_2 | 0.721 | | | | 2.755 | |
| | PCA_3 | 0.718 | | | | 1.931 | |
| | ~~PCA_4~~ | ~~0.866~~ | | | | ~~5.762~~ | REMOVED |
| | PCA_5 | 0.729 | | | | 1.549 | |
| **PCD** | | | 0.834 | 0.835 | 0.627 | | |
| | ~~PCD_1~~ | ~~0.773~~ | | | | ~~5.427~~ | REMOVED |
| | PCD_2 | 0.774 | | | | 3.014 | |
| | PCD_3 | 0.812 | | | | 1.950 | |
| | ~~PCD_4~~ | ~~0.926~~ | | | | ~~5.541~~ | REMOVED |
| | PCD_5 | 0.789 | | | | 3.108 | |

Table 4-17: Sub-model 3 (Stage 1): Key metric values for assessment of measurement model

The discriminant validity for each of the first order constructs in sub-model 2 was assessed using the Fornell-Larcker Criterion. Like the results of sub-model 1 and sub-model 2, the results of sub-model 3 revealed that several constructs did not meet the threshold for discriminant validity, indicating potential issues with the distinctiveness between the constructs. This should be acknowledged as a limitation of this study. Table 4-18 presents the results of the Fornell-Larcker Criterion, highlighting in red the values where the square root of the AVE for a construct is not greater than the correlation coefficients between that construct and another construct.

| | TW | PC | RE | PRO | COMM | COOP | IR | PCR | PCS | PCA | PCD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **TW** | 0.755 | | | | | | | | | | |
| **PC** | 0.895 | 0.770 | | | | | | | | | |
| **RE** | 0.938 | 0.927 | 0.740 | | | | | | | | |
| **PRO** | 0.848 | 0.810 | 0.832 | 0.750 | | | | | | | |
| **COMM** | 0.782 | 0.669 | 0.732 | 0.908 | 0.745 | | | | | | |
| **COOP** | 0.801 | 0.719 | 0.801 | 0.884 | 0.910 | 0.796 | | | | | |
| **IR** | 0.692 | 0.588 | 0.702 | 0.789 | 0.804 | 0.906 | 0.797 | | | | |
| **PCR** | 0.414 | 0.447 | 0.469 | 0.548 | 0.581 | 0.477 | 0.491 | 0.794 | | | |
| **PCS** | 0.408 | 0.433 | 0.412 | 0.492 | 0.497 | 0.394 | 0.455 | 0.891 | 0.814 | | |
| **PCA** | 0.483 | 0.507 | 0.572 | 0.619 | 0.580 | 0.541 | 0.591 | 0.856 | 0.874 | 0.746 | |
| **PCD** | 0.384 | 0.498 | 0.412 | 0.472 | 0.504 | 0.427 | 0.425 | 0.808 | 0.804 | 0.751 | 0.792 |

Table 4-18: Sub-model 3 (Stage 1): Discriminant validity

### 4.2.6 SUB-MODEL 3: STAGE 2 OF THE PLS-SEM TWO-STAGE APPROACH

**Assessing Measurement Model of Second Order Constructs**

The model was estimated using the latent variable scores obtained from Stage 1 and was run using the Consistent PLS-SEM algorithm. All the factor loadings, Cronbach's alpha, composite reliability, AVE and VIF values met or exceeded the recommended thresholds. A detailed summary of these metrics is presented in Table 4-19 below. Furthermore, the Consistent PLS-SEM Bootstrapping algorithm was conducted using 5000 sub-samples, a two-tailed test and a significance level of 5. The analysis revealed statistically significant relationships between the first order constructs and second order constructs (t-value > 1.96). Table 4-19 presents the corresponding t-values and Figure 4-3 illustrates the factor loadings with the t-values shown in brackets.

| Second order constructs | First order constructs | Factor Loading (>0.6) | T-value (>1.96) | Cronbach's alpha (>0.6) | CR (>0.6) | AVE (> 0.5) | VIF (< 5) |
|---|---|---|---|---|---|---|---|
| **Individual Competence (X)** | | | | 0.919 | 0.922 | 0.792 | |
| | TW | 0.835 | 9.261 | | | | 3.329 |
| | PC | 0.931 | 12.010 | | | | 3.238 |
| | RE | 0.902 | 13.897 | | | | 3.431 |
| **Collective Competence (Y)** | | | | 0.920 | 0.924 | 0.792 | |
| | PRO | 0.940 | 15.018 | | | | 3.433 |
| | COMM | 0.880 | 10.376 | | | | 2.920 |
| | COOP | 0.790 | 7.510 | | | | 4.022 |
| | IR | 0.829 | 10.250 | | | | 2.661 |
| **Organizational Competence (Z)** | | | | 0.912 | 0.919 | 0.723 | |
| | PCR | 0.871 | 13.107 | | | | 3.440 |
| | PCS | 0.793 | 8.774 | | | | 3.672 |
| | PCA | 0.768 | 8.119 | | | | 2.211 |
| | PCD | 0.956 | 12.575 | | | | 2.709 |

Table 4-19: Sub-model 3 (Stage 2): Key metric values for assessment of measurement model

The discriminant validity for each of the second order constructs in sub-model 3 was assessed using the Fornell-Larcker Criterion. The results revealed that all the constructs met the threshold for discriminant validity, indicating no issues with the distinctiveness between the constructs. Table 4-20 presents the results of the Fornell-Larcker Criterion.

| | Collective Competence (Y) | Individual Competence (X) | Organizational Competence (Z) |
|---|---|---|---|
| **Collective Competence (Y)** | 0.862 | | |
| **Individual Competence (X)** | 0.837 | 0.890 | |
| **Organizational Competence (Z)** | 0.599 | 0.519 | 0.850 |

Table 4-20: Sub-model 3 (Stage 2): Discriminant validity

**Assessing Structural Model of Second Order Constructs**

The coefficient of determination ($R^2$) and effect size index ($f^2$) were also calculated, and the results are presented in Table 4-21 below. The $R^2$ for individual competence was 0.269, indicating that individual competence accounts for 26.9% of the variance in organizational

competence. This represents a moderate effect as it exceeds the 0.25 threshold but is below the threshold of 0.75. The $R^2$ for collective competence was 0.359, suggesting that collective competence explains 35.9% of the variance in organizational competence. This is also considered a moderate effect based on the same threshold criteria.

Regarding effect size, the $f^2$ for individual competence was 0.369, indicating a large effect as it significantly exceeds the threshold of 0.35. This suggests that organizational competence has a dominant influence on individual competence within the model. The $f^2$ for collective competence was 0.560, which also reflects a large effect, further supporting the strong predictive role of organizational competence in explaining both individual and collective competence.

| | **Coefficient of determination ($R^2$)** | | **Effect size ($f^2$)** | |
|---|---|---|---|---|
| **Individual Competence (X)** | 0.269 | Moderate effect | 0.369 | Large effect |
| **Collective Competence (Y)** | 0.359 | Moderate effect | 0.560 | Large effect |

Table 4-21: Sub-model 3 (Stage 2): Coefficient of determination ($R^2$) and effect size ($f^2$)

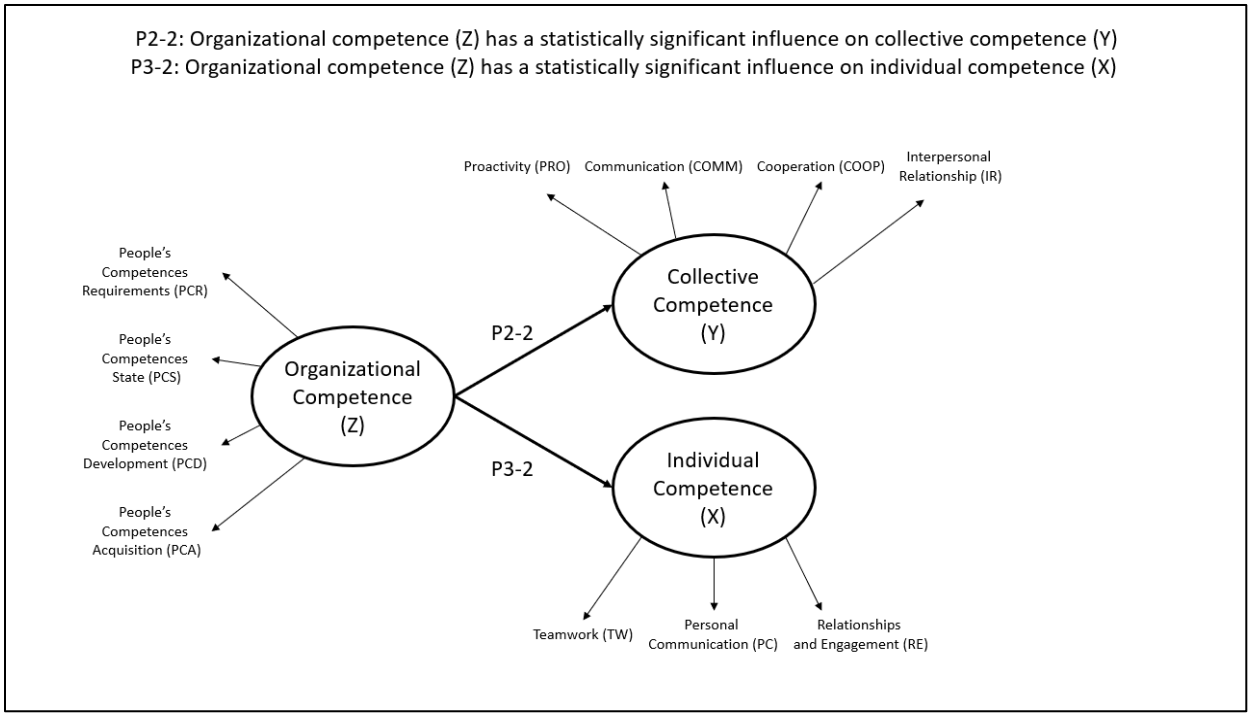
**Assessing Testable Propositions and Abductive Working Hypotheses**

To calculate the p-values and t-values of the model, the Consistent PLS-SEM Bootstrapping algorithm was applied using 5000 sub-samples, a two-tailed test and a significance level of 5%, as recommended by Hair et al. (2022). The p-values for the relationships between Z -> Y and Z -> X were both 0.000, and the corresponding t-values exceeded 2.58, indicating statistical significance at the 1% level. Overall, these results confirm that both relationships are statistically significant, supporting P2-2 and P3-2 and thus H2-2 and H3-2, which is presented in Table 4-22 below.

| | Relationship | Abductive Working Hypotheses | | Testable Proposition | Path Coefficients | P-value | T-Value | Conclusion |
|---|---|---|---|---|---|---|---|---|
| H2-2 | Z -> Y | Organizational competence (Z) influences collective competence (Y) | P2-2 | Organizational competence (Z) has a statistically significant influence on collective competence (Y) | 0.599 | 0.000 | 5.529 | Supported |
| H3-2 | Z -> X | Organizational competence (Z) influences individual competence (X) | P3-2 | Organizational competence (Y) has a statistically significant influence on individual competence (X) | 0.519 | 0.000 | 5.158 | Supported |

Table 4-22: Sub-model 3: Abductive working hypotheses and testable propositions

Moreover, Figure 4-3 below provides a visual representation of the final model for sub-model 3 in PLS-SEM, which includes the factor loadings with the corresponding t-values shown in brackets. This figure is shown alongside the initial sub-model 3, which illustrates the testable propositions P2-2 and P3-2. By comparing both versions, it is clear that the final model supports and validates the proposed relationships.



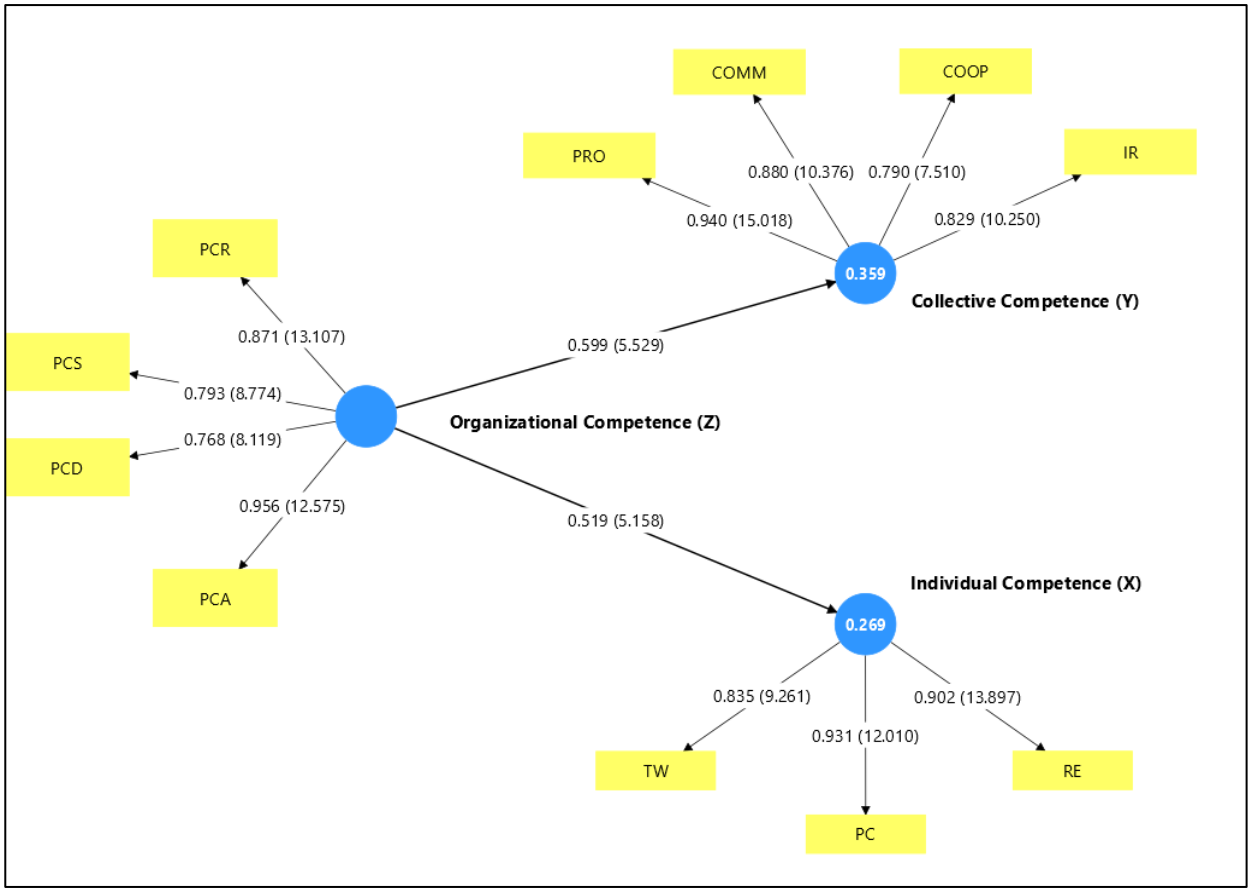




Figure 4-3: Results of sub-model 3 (P2-2 and P3-2)

## 4.3 SUMMARY OF THE SIGNIFICANCE AND RELEVANCE OF THE RESEARCH HYPOTHESES

Based on the process of the PLS-SEM two-stage approach that was carried out in the previous section, the results of the data analysis support all six hypotheses, as presented in Table 4-23. The following paragraphs detail the path coefficient and significance of the six hypotheses.

**H1-1: Individual competence (X) influences collective competence (Y)**

The first hypothesis explores the relationship between individual competence (X) and collective competence (Y). As shown in Table 4.23, the path coefficient for this relationship was 0.840, with a t-value of 16.300, which exceeds the critical threshold of 1.96. This strong statistical evidence supports the acceptance of Hypothesis 1-1. Therefore, individual competence has a positive effect on collective competence.

**H1-2: Collective competence (Y) influences individual competence (X)**

The second hypothesis explores the relationship between collective competence (Y) and individual competence (X). As shown in Table 4.23, the path coefficient for this relationship was 0.842, with a t-value of 16.619, which exceeds the critical threshold of 1.96. This strong statistical evidence supports the acceptance of Hypothesis 1-2. Therefore, collective competence has a positive effect on individual competence.

**H2-1: individual competence (Y) influences organizational competence (Z)**

The third hypothesis explores the relationship between collective competence (Y) and organizational competence (Z). As shown in Table 4.23, the path coefficient for this relationship was 0.596, with a t-value of 5.415, which exceeds the critical threshold of 1.96. This strong statistical evidence supports the acceptance of Hypothesis 2-1. Therefore, collective competence has a positive effect on organizational competence.

**H2-2: Organizational competence (Z) influences collective competence (Y)**

The fourth hypothesis explores the relationship between organizational competence (Z) and collective competence (Y). As shown in Table 4.23, the path coefficient for this relationship

was 0.599, with a t-value of 5.529, which exceeds the critical threshold of 1.96. This strong statistical evidence supports the acceptance of Hypothesis 2-2. Therefore, organizational competence has a positive effect on collective competence.

**H3-1: Individual competence (X) influences organizational competence (Z)**

The fifth hypothesis explores the relationship between individual competence (X) and organizational competence (Y). As shown in Table 4.23, the path coefficient for this relationship was 0.529, with a t-value of 5.122, which exceeds the critical threshold of 1.96. This strong statistical evidence supports the acceptance of Hypothesis 3-1. Therefore, individual competence has a positive effect on organizational competence.

**H3-2: Organizational competence (Z) influences individual competence (X)**

The sixth hypothesis explores the relationship between organizational competence (Z) and individual competence (X). As shown in Table 4.23, the path coefficient for this relationship was 0.519, with a t-value of 5.158, which exceeds the critical threshold of 1.96. This strong statistical evidence supports the acceptance of Hypothesis 3-2. Therefore, organizational competence has a positive effect on individual competence.

| | Relationship | Abductive Working Hypotheses | | Testable Proposition | Path Coefficients | P-value | T-Value | Conclusion |
|---|---|---|---|---|---|---|---|---|
| H1-1 | X -> Y | Individual competence (X) influences collective competence (Y) | P1-1 | Individual competence (X) has a statistically significant influence on collective competence (Y) | 0.840 | 0.000 | 16.300 | Supported |
| H1-2 | Y -> X | Collective competence (Y) influences individual competence (X) | P1-2 | Collective competence (Y) has a statistically significant influence on individual competence (X) | 0.842 | 0.000 | 16.619 | Supported |
| H2-1 | Y -> Z | Collective competence (X) influences organizational competence (Z). | P2-1 | Collective competence (Y) has a statistically significant influence on organizational competence (Z) | 0.596 | 0.000 | 5.415 | Supported |
| H2-2 | Z -> Y | Organizational competence (Z) influences collective competence (Y) | P2-2 | Organizational competence (Z) has a statistically significant influence on collective competence (Y) | 0.599 | 0.000 | 5.529 | Supported |
| H3-1 | X -> Z | Individual competence (X) influences organizational competence (Z). | P3-1 | Individual competence (X) influences organizational competence (Z) | 0.529 | 0.000 | 5.122 | Supported |
| H3-2 | Z -> X | Organizational competence (Z) influences individual competence (X) | P3-2 | Organizational competence (Y) has a statistically significant influence on individual competence (X) | 0.519 | 0.000 | 5.158 | Supported |

Table 4-23: Results of all abductive hypothesis and testable propositions

Overall, the results of the analysis revealed strong and statistically significant relationships among the constructs. Notably, the largest path coefficients were observed between X and Y, with a value of 0.840 from X -> Y and a similar value of 0.842 from Y -> X. The second strongest bidirectional relationship was observed between Y and Z, with a value of 0.596 from Y -> Z and a value of 0.599 from Z -> Y. The smallest path coefficients were observed between X and Z, with a value of 0.529 from X -> Z and a value of 0.519 from Z -> X. The analysis shows consistent and strong bidirectional associations across the model as well as similar path coefficients within each bidirectional pair, as shown in Figure 4-4 below.

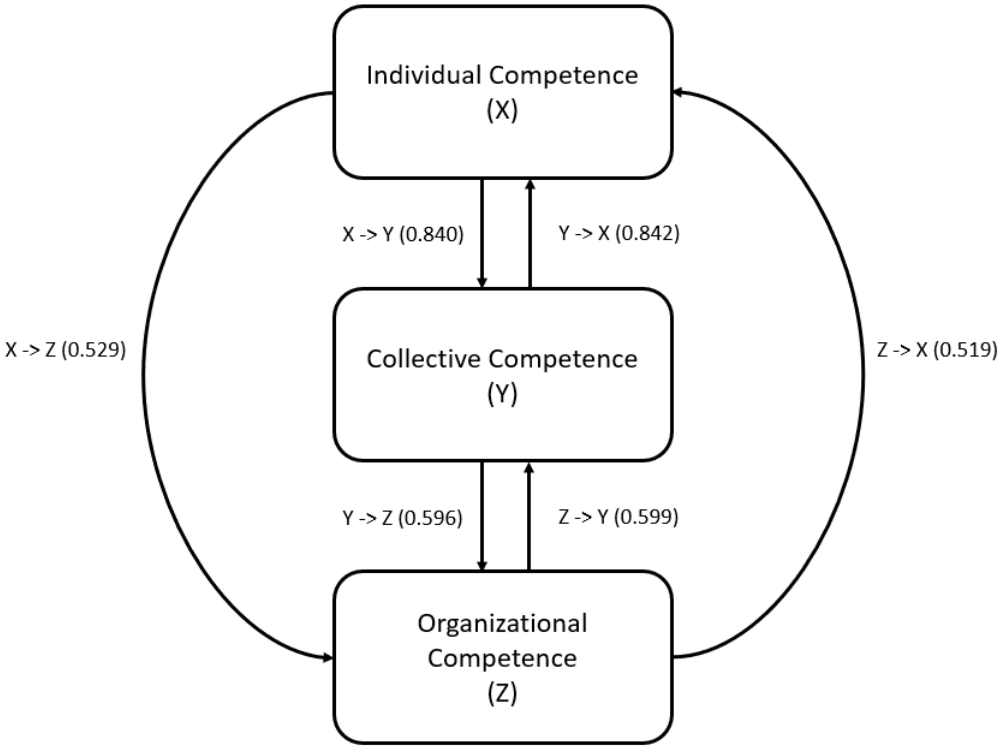



Figure 4-4: Conceptual model with path coefficients from data analysis

## 4.4 SUMMARY OF COEFFICIENT OF DETERMINATION

As part of the PLS-SEM two stage approach, the coefficient of determination ($R^2$) for each endogenous construct in the three distinct sub-models was assessed in Section 4.2. $R^2$ reflects the percentage of variance in the dependent variable, that is explained by the independent variable. According to Hair et al. (2011), an $R^2$ value above 0.75 is considered substantial, above 0.5 is moderate and above 0.25 is weak. A summary of the results is presented in Table 4-24 below.

| | Endogenous Construct | $R^2$ | Explained by Exogenous Construct |
|---|---|---|---|
| Sub-model 1 | Collective Competence (Y) | 0.705 | Individual Competence |
| | Organizational Competence (Z) | 0.280 | |
| Sub-model 2 | Individual Competence (X) | 0.709 | Collective Competence |
| | Organizational Competence (Z) | 0.355 | |
| Sub-model 3 | Individual Competence (X) | 0.269 | Organizational Competence |
| | Collective Competence (Y) | 0.359 | |

Table 4-24: Summary of coefficient of determination

For sub-model 1, the results show that the $R^2$ for collective competence was 0.705, indicating that individual competence accounts for 70.5% of the variance in collective competence. The $R^2$ for organizational competence was 0.280, meaning individual competence explains 28.0% of the variance in organizational competence. Since both $R^2$ values are above 0.5 but below 0.75, they are moderate.

For sub-model 2, the results show that the $R^2$ for individual competence was 0.709, indicating that collective competence explains 70.9% of the variance in individual competence. The $R^2$ for organizational competence was 0.355, with collective competence accounting for 35.5% of the variance in organizational competence. Again, both $R^2$ values are moderate as they fall between 0.5 and 0.75.

In sub-model 3, the $R^2$ for individual competence was 0.269, showing that organizational competence contributed to explaining 26.9% of the variance in individual competence. The $R^2$ for collective competence was 0.359, indicating that organizational competence accounts for 35.9% of the variance in collective competence. These $R^2$ values are also moderate given that they are above 0.25 but below 0.75.

## 4.5 SUMMARY OF MEASUREMENT OF EFFECT SIZES

The effect size ($f^2$) offers additional insight by quantifying the impact of the independent variable on the coefficient of determination ($R^2$) of the dependent construct (Hair et al., 2022). An $f^2$ greater than 0.35 is considered to have a large effect, an $f^2$ greater than 0.15 is considered to have a medium effect and an $f^2$ greater than 0.02 is considered to have a small effect (Geert van den Berg, 2024; Kock & Hadaya, 2018).

As part of the PLS-SEM two stage approach, the effect sizes ($f^2$) for each independent variable in the three distinct sub-models was assessed in Section 4.2 and is summarized in Table 4-25 below. Individual competence plays a greater role in shaping collective competence (2.442) than organizational competence (0.369). Collective competence plays a greater role in shaping individual competence (2.395) than organizational competence (0.560). Lastly, organizational competence plays a greater role in shaping collective competence (0.552) than individual competence (0.388). Notably, all the independent variables had $f^2$ values that exceeded 0.35, indicating that each independent variable had a large effect on the coefficient of determination of their respective dependent constructs.

| | | **Individual Competence (X)** | **Collective Competence (Y)** | **Organizational Competence (Z)** |
|---|---|---|---|---|
| **Sub-model 1** | **Individual Competence (X)** | | 2.442 | 0.369 |
| **Sub-model 2** | **Collective Competence (Y)** | 2.395 | | 0.560 |
| **Sub-model 3** | **Organizational Competence (Z)** | 0.388 | 0.552 | |

Table 4-25: Summary of measurement of effect sizes

# CHAPTER 5 : DISCUSSION AND CONCLUSIONS

This chapter begins with a comprehensive analysis of the research findings in relation to the existing body of literature. Sections 5.1.1 to 5.1.3 examine the bidirectional relationships explored in the study across the individual, collective and organizational levels of competence. Sections 5.1.5 to 5.1.7 focus on how each level of competence is represented through its associated indicators, providing further insight into the underlying constructs. The chapter then outlines the theoretical and practical contributions of the research before addressing the limitations and offering recommendations for future research. It concludes with a summary of the study's overall contributions and key takeaways.

## 5.1 DISCUSSION

The existing literature on project management competence tends to focus on the individual level, with comparatively less attention given to the collective and organizational levels. Moreover, few studies use a multilevel approach, particularly regarding how (and how much) these different levels of competence interact and influence each other. To address this gap, the present study was conducted to investigate the relationships between individual, collective and organizational competence. In other words, the main research question asks: how is project management competence shaped from a multilevel perspective? The findings reveal a positive and reciprocal influence across all three levels.

Data was collected through an online survey targeting individuals with experience working on a project within the past two years. A total of 101 participants completed the survey, of whom 56% were male and 46% female. The majority of respondents held a Master's degree (54%), with the largest age group being 25-34 years old (29.7%). Most respondents identified as competent practitioners (30%) and worked in the IT sector (23.7%) and Government and Public Sector (23.7%). Participants were asked to reflect on a specific project they had worked on in the last two years when responding to the survey. The most selected project type was Computer Software Development (26.7%), with most projects classified as having medium complexity (59%) and most respondents reported their role as that of project team member (41%).

The data provided by the respondents was analyzed using the PLS-SEM two-stage approach. In the first stage, the measurement model for the first order constructs was assessed, focusing on key metrics such as factor loadings, Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), discriminant validity, and variance inflation factor (VIF). In the second stage, the latent variable scores derived from the first stage were used to build the measurement model for the second order constructs, which was then assessed using the same set of metrics as in the first stage. Subsequently, the structural model for the second order constructs was assessed using key metrics such as path coefficient, coefficient of determination ($R^2$), effect size ($f^2$), as well as t-values and p-values. The results of the findings are discussed in detail below.

### 5.1.1 THE BIDIRECTIONAL RELATIONSHIP BETWEEN INDIVIDUAL COMPETENCE (X) AND COLLECTIVE COMPETENCE (Y)

In this study, individual competence was defined using three dimensions outlined in the Individual Competence Baseline for Project, Programme & Portfolio Management (IPMA, 2015): 1. Teamwork; 2. Personal Communication and; 3. Relationships and Engagement. Given the absence of a framework specifically tailored for collective competence within the existing project management bodies of knowledge, collective competence was defined using an instrument to measure collective competences in IT teams developed by Macke and Crespi (2016). This framework included four dimensions: 1. Proactivity; 2. Communication; 3. Cooperation; and 4. Interpersonal relationship.

The findings of the study indicated a strong positive and reciprocal relationship between individual and collective competence, suggesting that individual competence continuously evolves in tandem with the competence of the project team and vice versa. As individual team members enhance their own competence, they contribute to the overall competence of the team. In turn, as the team becomes collectively more competent, it reinforces and supports the growth of individual team members.

Notably, the path coefficients between these two constructs were the largest in the structural model (X -> Y: 0.840 and Y -> X: 0.842). The value of the path coefficients is very close, suggesting a balanced and mutual influence. This was the strongest bidirectional relationship observed in the model, which can perhaps be attributed to the immediate and visible

feedback loop between individuals and their project teams. Unlike the more abstract and indirect relationship between individuals or teams and the broader organization, the team environment offers a direct and tangible environment for individuals to apply their skills and receive feedback.

This is consistent with the current literature, particularly with the framework proposed by Wiewiora et al. (2019), that identifies dynamic two-way interactions (both feed-forward and feedback relationships) between the individual and collective levels of learning. The authors highlight shared mental models as a key mechanism for facilitating feedback and feedforward knowledge transfer across these two levels as follows:

> "Individuals' mental models are shared with others through the use of examples, dialog, negotiation, observations and imitations of others. Practicing together, joint problem solving and discussion can then help create shared understanding that contributes to collective knowledge" (p. 106).

In addition, Wiewiora et al. (2019) also found that both formal and informal network, such as study circles, workshops, and other collaborative opportunities, play a role in fostering learning between individuals and teams. Feedback also emerged as an important mechanism, as it commonly occurs between individuals and groups, influencing the flow of learning across levels.

Although the present study did not explicitly examine any of these contextual factors, the results offer empirical support for the reciprocal nature of competence development between the individual and collective levels, as outlined by Wiewiora et al. (2019). The results suggest that competence development is the strongest between the individual and collective levels, potentially driven by daily collaboration, shared mental models, networks, and feedback.

### 5.1.2 THE BIDIRECTIONAL RELATIONSHIP BETWEEN COLLECTIVE COMPETENCE (Y) AND ORGANIZATIONAL COMPETENCE (Z)

In addition to the definition of collective competence presented in Section 5.1.1, this study defined organizational competence based on four dimensions outlined in the Organisational Competence Baseline for Developing Competence in Managing by Projects (IPMA, 2016): 1. People's Competences Requirements; 2. People's Competences State; 3. People's Competences Acquisition; and 4. People's Competences Development.

The findings revealed a strong, positive, and reciprocal relationship between collective and organizational competence. The path coefficients between these two constructs were the second largest in the structural model (Y -> Z: 0.596 and Z -> Y: 0.599). As with the relationship between individual and collective competence, the near-equal values of the path coefficients suggest a balanced and mutual influence. These results indicate that collective competence evolves alongside organizational competence and vice versa. As the organization strengthens its competence-related practices, it fosters the development of more capable and cohesive teams. In turn, as teams become more competent, they contribute to enhancing the organization's overall competence capacity.

These findings align with the work of Melkonian and Picq (2011), who demonstrated a bidirectional relationship (top-down and bottom-up relationship) between organizational project capabilities and team competence, using a Special Forces unit as a case study. The top-down aspect involved HR practices that ensured the recruitment and ongoing training of highly skilled individuals. The bottom-up aspect highlighted how project activities such as post-mission debriefs drove innovation and organizational learning, resulting in adjustments to routines, resource allocation and structures that enhanced future team performance.

In the present study, the relationship between the collective and organizational levels emerged as the second weakest in the model. This may be explained by various bridging mechanisms that influence knowledge transfer between project teams and the organizations including organizational culture, leadership, structural arrangements, and internal political dynamics (Wiewiora et al., 2019). For example, the findings by Wiewiora et al. (2019) suggest that organizational structures like project management offices can help to bridge the gap between project and organizational learning.

Moreover, the temporary nature of project teams may further weaken the relationship between the collective and organizational levels. As Brady and Davies (2004) observed, when a project ends "members of the disbanded team often have little time or motivation to reflect on their experience and document transferable knowledge for recycling in future projects" (p. 1601). This lack of consistent knowledge transfer from the team to the organization limits the extent to which

collective competence can be embedded into the organization's broader competence base, further reducing the strength of the relationship.

### 5.1.3 THE BIDIRECTIONAL RELATIONSHIP BETWEEN INDIVIDUAL COMPETENCE (X) AND ORGANIZATIONAL COMPETENCE (Z)

Lastly, the study identified a positive and reciprocal relationship between individual and organizational competence. Although the path coefficients between these two constructs were the smallest in the structural model (X -> Z: 0.529 and Z -> X: 0.519), their close values still indicate a balanced and mutual influence. These findings indicate that individual competence and organizational competence evolve together. As organizations improve their processes and practices to support competence, both by developing existing employees and attracting the right talent, they foster individual growth. In turn, as individuals become more skilled, they contribute to strengthening the organization's overall competence. For example, Melkonian and Picq (2011) found that organizational HR practices contributed to individual competence development over time through the ongoing training and development of Special Forces personnel throughout their careers.

Despite its significance, this relationship emerged as the weakest among the three examined, likely due to its abstract and indirect nature. The influence between individuals and the broader organization is often mediated by contextual factors such as leadership, which serves as the primary means to translate organizational strategies and values into individual-level impacts. As noted by Wiewiora et al. (2019), leaders play a critical role in facilitating this gap, serving as enablers of learning at the organizational level. However, in this study, most respondents identified as project team members (40.6%), rather than leaders or managers, potentially limiting their perceived ability to directly shape or be shaped by organizational competence. In other words, they may have limited visibility and understanding of organizational-level process and impacts. This could explain why the influence between individual and organizational is weaker than in the individual-collective relationship.

Interestingly, the strength of the relationships between the individual and organizational level was very similar to the relationships between the collective and organizational levels. This may be due to the fact that the individual and collective levels both rely on similar bridging

mechanisms for knowledge transfer to the organizational level, including, culture, leadership, organizational structures, political dynamics (Wiewiora et al., 2019). Specifically, regarding the relationship between the individual and organizational level, an organizational culture that does not actively support learning may discourage individuals or teams from speaking up, thereby limiting their ability to influence broader policy or process changes. Leadership, once again, plays a crucial role in shaping this type of organizational culture and enabling or constraining learning across these levels.

### 5.1.4 SUMMARY OF THE BIDIRECTIONAL RELATIONSHIPS BETWEEN INDIVIDUAL, COLLECTIVE, AND ORGANIZATIONAL COMPETENCE

In summary, the findings of this study provide evidence of bidirectional relationships among individual, collective and organizational competence levels. These results align closely with prior research, reinforcing the theoretical perspectives and empirical evidence presented in the literature on the interconnectedness of competence across various levels of the organization (Brady & Davies, 2004; Melkonian & Picq, 2011; Wiewiora et al., 2019).

Some of the findings were explained using the notion of bridging mechanisms proposed by Wiewiora et al. (2019). They may potentially explain the varying strengths of the bidirectional relationships among the competence levels. Although this study did not directly examine these bridging mechanisms, they present an interesting avenue for future research to better understand the contextual factors that may mediate or moderate the relationship between competence levels.

Table 5-1 below summarizes the key points discussed in Sections 5.1.1 to 5.1.3, aligning the findings with the study's corresponding research objectives and research questions.

| Specific Research Objectives | Specific Research Questions | Answers to Research Questions |
|---|---|---|
| Understand the relationship between individual competence (X) and collective competence (Y) | RQ1: What is the nature of the influence between individual competence (X) and collective competence (Y)? | ○ The relationship is positive and bidirectional.<br>○ It is the strongest bidirectional relationship across the structural model.<br>○ Results are consistent with the existing literature:<br>o Wiewiora et al. (2019) identified feed-forward and feedback relationships between individual and collective competence through shared mental models, networks, and feedback. |
| Understand the relationship between collective competence (Y) and organizational competence (Z) | RQ2: What is the nature of the influence between collective competence (Y) and organizational competence (Z)? | ○ The relationship is positive and bidirectional.<br>○ It is the second strongest bidirectional relationship across the structural model.<br>○ Results are consistent with the existing literature:<br>o Melkonian and Picq (2011) demonstrated a top-down and bottom-up relationship between organizational project capabilities and team competence, using a Special Forces unit as a case study.<br>o Wiewiora et al. (2019) suggested bridging mechanisms influence knowledge transfer between project teams and the organizations including organizational culture, leadership, structural arrangements, and internal political dynamics.<br>o Brady and Davies (2004) observed a lack of consistent knowledge transfer from the team to the organization in project settings. |
| Understand the relationship between individual competence (X) and organizational competence (Z) | RQ3: What is the nature of the influence between individual competence (X) and organizational competence (Z)? | ○ The relationship is positive and bidirectional.<br>○ It is the weakest bidirectional relationship across the structural model.<br>○ Results are consistent with the existing literature:<br>o Melkonian and Picq (2011) demonstrated a top-down relationship between organizational HR capabilities and individual competence.<br>o Wiewiora et al. (2019) suggested simialr bridging mechanisms influence knowledge transfer between individuals and the organizations (compared to project teams and the organization) including organizational culture, leadership, structural arrangements, and internal political dynamics. |

Table 5-1: Summary of bidirectional relationships between Individual (X), Collective (Y), and Organizational (Z) Competence

### 5.1.5 INDIVIDUAL COMPETENCE (X) REPRESENTED THROUGH TEAMWORK, PERSONAL COMMUNICATION, AND RELATIONSHIPS AND ENGAGEMENT

This section presents the results regarding the representation of individual competence (X) through its corresponding indicators: Teamwork (TW), Personal Communication (PC), and Relationships and Engagement (RE), as examined across the three sub-models. The analysis revealed that all these relationships are strong and statistically significant, with factor loadings greater than 0.6 and t-values greater than 1.96, as summarized in Table 5-2 below. Overall, these findings validate the existing literature such as Crawford and Pollack (2004) and Hefley and Bottion (2021) that emphasize the importance of soft skills, in addition to technical skills, as an essential component of individual competence in project management.

| | **Sub-model 1** | | **Sub-model 2** | | **Sub-model 3** | |
|---|---|---|---|---|---|---|
| | **Factor Loading (>0.6)** | **T-Value (>1.96)** | **Factor Loading (>0.6)** | **T-value (>1.96)** | **Factor Loading (>0.6)** | **T-value (>1.96)** |
| **TW** | 0.904 | 22.196 | 0.934 | 24.856 | 0.835 | 9.261 |
| **PC** | 0.865 | 15.148 | 0.840 | 14.533 | 0.931 | 12.010 |
| **RE** | 0.901 | 25.858 | 0.894 | 23.806 | 0.902 | 13.897 |

Table 5-2: Individual Competence (X) Indicators - Factor loadings and t-values

**Teamwork (TW)**

In this study, teamwork was selected as one of the key elements of individual competence, based on the framework provided by the Individual Competence Baseline for Project, Programme & Portfolio Management (IPMA, 2015). According to the IPMA, teamwork encompasses a range of skills that are necessary for effective collaboration. These include selecting and building the right team, promoting cooperation and networking between team members, supporting, facilitating and reviewing the development of the team and its members, empowering teams by delegating tasks and responsibilities and recognising errors to facilitate learning from mistakes.

Among the three indicators used to represent individual competence, the analysis revealed that Teamwork had the highest factor loadings in both sub-model 1 (X -> TW: 0.904) and sub-model 2 (X -> TW: 0.934). Given that sub-model 1 (X -> Y) and sub-model 2 (Y-> X) examine

the bidirectional relationships between individual and collective competence, it makes sense for teamwork to be a significant aspect of individual competence. In this context, the ability for an individual to work effectively as part of a team would be an essential skill.

Conversely, Teamwork exhibited the lowest factor loading in sub-model 3 (X -> TW: 0.835), where sub-model 3 (Z -> X) examines the relationship from organizational competence to individual competence. This suggests that the importance of Teamwork diminishes when it is influenced by organizational competence. One possible explanation is that in highly structured process-driven environments, organizations may favour technical skills over soft skills such as teamwork (Huemann et al., 2007).

Within the Teamwork construct, two indicators stood out as particularly significant across all the sub-models: TW_3 (*I support, facilitate and review the development of the team and its members*) and TW_5 (*I recognize errors to facilitate learning from mistakes*). These findings highlight the importance of a psychologically safe team environment, where individuals feel safe enough to acknowledge mistakes, provide constructive feedback, and engage in continuous learning. According to Edmonston (1999), employees who perceive their work environment as supportive and non-punitive are more likely to embrace errors as learning opportunities and actively seek feedback. Alternatively, the authors found that a lack of psychological safety can lead to a reluctance to ask for help, which hinders both individual and team performance.

These behaviours are particularly important in project settings, where collaboration, rapid learning, and adaptability are essential. In this context, project managers and team leaders play a critical role in fostering trust, openness, and learning. As Anantatmula (2010) suggests, leadership that emphasizes clear communication, consistent processes, and visible support from senior management contributes significantly to establishing trust, where learning and development are a priority. Creating a safe and structured environment enables individuals to grow and positively influence the collective competence of the project team.

**Personal Communication (PC)**

Personal Communication was selected as another one of the key elements of individual competence, based on the framework provided by the Individual Competence Baseline for Project, Programme & Portfolio Management (IPMA, 2015). According to the IPMA, Personal

Communication involves providing clear and structured information to others and verifying their understanding, facilitating and promoting open communication, choosing communication styles and channels to meet the needs of the audience, situation and management level, communication effectively with virtual teams, and employing humour and a sense of perspective when appropriate.

Among the three indicators used to represent individual competence, the analysis revealed that Personal Communication had the lowest factor loadings in both sub-model 1 (X -> PC: 0.865) and sub-model 2 (X -> PC: 0.840). These two sub-models represent bidirectional relationships between individual and collective competence. The lower factor loadings suggest that communication may function independently from individual competence when compared to other aspects such as Teamwork or Relationships and Engagement. This is consistent with research suggesting that communication effectiveness may rely on contextual factors such as team climate and leadership support, rather than individual competences alone (de Vries & Angelique, 2010).

Conversely, Personal Communication emerged as the having the highest factor loading in sub-model 3 (X -> PC: 0.931), where sub-model 3 (Z -> X) examines the relationship from organizational competence to individual competence. This suggests that organizational structures and policies, have a strong influence on the development of communication skills at the individual level. The organizational environment plays a key role in shaping how individuals tailor their communication, such as the use of digital platforms in virtual and multicultural settings (Tenzer et al., 2014), and in fostering a climate of psychological safety that encourages transparent and open communication throughout the organization (Edmonston, 1999).

Within the Personal Communication construct, PC_3 (*I facilitate and promote open communication*) received the highest weight among the indicators across all three sub-models. Internal communication is widely recognized as a critical activity that can motivate employees, foster trust, build a shared sense of identity, enhance overall engagement, allow individuals to express their emotions, share aspirations and recognize achievements (Berger, 2008; Men, 2014).

**Relationships and Engagement (RE)**

Lastly, Relationships and Engagement was selected as the third element of individual competence, based on the framework provided by the Individual Competence Baseline for Project, Programme & Portfolio Management (IPMA, 2015). According to the IPMA, Relationships and

Engagement focuses on initiating and developing personal and professional relationships, building, facilitating and contributing to social networks, demonstrating empathy through listening, understanding and support, showing confidence and respect by encouraging others to share their opinions or concerns, and sharing own vision and goals to gain the engagement and commitment of others.

Among the three indicators used to represent individual competence, the analysis revealed that Relationships and Engagement emerged as second highest across all three sub-models: (X -> RE: 0.901), sub-model 2 (X -> RE: 0.894) and sub-model 3 (X -> RE: 0.902). This suggests that the ability to build strong interpersonal connections and engage meaningfully with others is an important and consistent aspect of individual competence, regardless of the relationship it may have with collective and organizational competence.

Within the Relationships and Engagement construct, RE_1 (*I initiate and develop personal and professional relationships*) received the highest weight among the indicators across all three sub-models. These findings are consistent with the current literature which highlights the importance of relationship building in fostering positive individual and organizational outcomes (Boyatzis, 2007). In particular, strong relationships between leaders and followers have been linked to enhanced job satisfaction, improved performance and higher quality leader-member exchanges (Kwak & Jackson, 2015; Nahrgang et al., 2009).

#### 5.1.5.1 SUMMARY OF FINDINGS

Overall, the findings align with the existing literature that conceptualizes Individual Competence (X) through Teamwork, Personal Communication, and Relationships and Engagement. The study identified several significant indicators within each of these dimensions, validating the constructs as key aspects of individual competence. These indicators are consistent with previously established research. A detailed summary of these findings, including the significant indicators associated with each dimension is presented in Table 5-3 below.

| **Individual Competence (X)** | | |
|---|---|---|
| **First order construct** | **Significant indicator(s)** | **References to Support Findings** |
| Teamwork (TW) | TW_3: I support, facilitate and review the development of the team and its members.<br><br>TW_5: I recognize errors to facilitate learning from mistakes. | Employees who perceive their work environment as psychologically safe are more likely to embrace errors as learning opportunities and actively seek feedback (Edmonston, 1999).<br><br>Leadership that emphasizes communication, processes, and support from senior management contributes to establishing trust, where learning and development are a priority (Anantatmula, 2010). |
| Personal Communication (PC) | PC_3: I facilitate and promote open communication. | Communication effectiveness may rely on contextual factors such as team climate and leadership support, rather than individual competences alone (de Vries & Angelique, 2010).<br><br>The organizational environment plays a key role in shaping how individuals tailor their communication (Edmonston, 1999; Tenzer et al., 2014).<br><br>Internal communication can motivate employees, foster trust, build a shared sense of identity, enhance overall engagement, allow individuals to express their emotions, share aspirations and recognize achievements (Berger, 2008; Men, 2014). |
| Relationships and Engagement (RE) | RE_1: I initiate and develop personal and professional relationships. | Strong relationships between leaders and followers have been linked to enhanced job satisfaction, improved performance and higher quality leader-member exchanges (Kwak & Jackson, 2015; Nahrgang et al., 2009). |

Table 5-3: Summary of findings - Individual Competence (X) represented through TW, PC, and RE

### 5.1.6 COLLECTIVE COMPETENCE (Y) REPRESENTED THROUGH PROACTIVITY, COMMUNICATION, COOPERATION, AND INTERPERSONAL RELATIONSHIP

This section presents the results regarding the relationships between collective competence (Y) and its corresponding indicators: Proactivity (PRO), Communication (COMM), Cooperation (COOP) and Interpersonal Relationship (IR), as examined across the three sub-models. The analysis revealed that all these relationships are strong and statistically significant, with factor loadings greater than 0.6 and t-values greater than 1.96, as summarized in Table 5-4 below.

| | Sub-model 1 | | Sub-model 2 | | Sub-model 3 | |
|---|---|---|---|---|---|---|
| | **Factor Loading (>0.6)** | **T Value (>1.96)** | **Factor Loading (>0.6)** | **T-value (>1.96)** | **Factor Loading (>0.6)** | **T-value (>1.96)** |
| **PRO** | 0.981 | 22.542 | 0.973 | 26.817 | 0.940 | 15.018 |
| **COMM** | 0.804 | 13.213 | 0.829 | 15.822 | 0.880 | 10.376 |
| **COOP** | 0.899 | 22.285 | 0.862 | 21.659 | 0.790 | 7.510 |
| **IR** | 0.754 | 10.035 | 0.778 | 11.813 | 0.829 | 10.250 |

Table 5-4: Collective Competence (Y) Indicators - Factor loadings and t-values

**Proactivity (PRO)**

For this study, Proactivity was selected as one of the four dimensions of collective competence based on the instrument to measure collective competences in IT teams developed by Macke and Crespi (2016). The authors define Proactivity as "the capacity to take responsibilities toward complex work situations, acting proactively [in the face of] unpredictable events" Macke and Crespi (2016, p. 2).

Among the four indicators used to represent collective competence, the analysis revealed that Proactivity exhibited the highest factor loadings across all three sub-models: (Y -> PRO: 0.981), sub-model 2 (Y -> PRO: 0.973) and sub-model 3 (Y -> PRO: 0.940). This finding indicates that Proactivity is the strongest and most influential component of collective competence within the scope of this study. Within the Proactivity construct, three indicators stood out as particularly significant across all the sub-models: PRO_4 (*When I have problems, my teammates usually help me*), PRO_7 *(My colleagues participate in team decision making with their suggestions*) and PRO_9 (*In our team colleagues usually share their knowledge*).

These results are consistent with the findings of Macke and Crespi (2016), who also identified Proactivity as the most significant factor influencing team perceptions about collective competence. In their research on IT teams, the authors suggested that this may be due to the nature of the IT work environment, which often foster individual technical tasks over social interaction. This would make communication and collaboration more challenging, especially

when dealing with clients or stakeholders outside of the technical domain. Therefore, the dimensions of Communication, Cooperation, and Interpersonal Relationship were found to have comparatively weaker influence on collective competence in their study. Interestingly, in the context of the present study, many of the respondents identified as working in the IT and Software industry (23.7%), which may help to explain the similar emphasis on Proactivity.

Additional research also demonstrates that proactivity at the team level significantly enhances collective outcomes. For instance, Junker et al. (2022) found that agile work practices foster team proactivity, which drives team effectiveness. Messmann (2023) also found that psychologically safe work environments lead to increased proactive behaviour and performance.

**Communication (COMM)**

Communication was identified as the second dimension of collective competence based on the instrument to measure collective competences in IT teams developed by Macke and Crespi (2016). According to the authors, Communication plays a significant role within the context of a team:

> "*To know how to communicate* is the development of a 'common operational language.' It is based on a deformation of the natural language that becomes a "dialect" unique to the team and that only applies in relation to the practices to which it refers. It can be more economical than the natural language, allowing for "minced words," "reading between the lines," and avoiding comments and explanations to save time." (p. 3).

In this study, among the four indicators used to represent collective competence, Communication ranked third in terms of factor loadings in both sub-model 1 (Y -> COMM: 0.804) and sub-model 2 (Y -> COMM: 0.829). These results are consistent with the findings of Macke and Crespi (2016) where Communication was also ranked third and did not exert as strong of an influence on collective competence as Proactivity and Cooperation.

Within the Communication construct, the indicator COMM_1 (*We recognize a tense situation and talk about it with team members*) received the highest weight among the indicators for Communication across all three sub-models: sub-model 1(0.769), sub-model 2 (0.763), and sub-model 3 (0.766). This suggests that the ability to address tension and engage in open dialogue

during challenging moments is an important aspect of communication in teams. It reflects the value placed on conflict resolution as an important dimension of team communication and collective competence. These findings align with the current literature on conflict within project teams, which emphasizes that effective communication mechanisms are essential for preventing and managing conflict within teams (Akiner, 2014; Macke & Crespi, 2016; Wu et al., 2017).

**Cooperation (COOP)**

Cooperation was identified as the third dimension of collective competence based on the instrument to measure collective competences in IT teams developed by Macke and Crespi (2016). The authors emphasize the critical role of cooperation in a team setting:

> "Collective competence exists when individual competences are made available, that is, it is necessary *to know how to cooperate*…It is necessary to 'know how to organize' points of view, representations, strategies, and criteria not only different but often conflicting and contradictory" (p. 3).

Among the four indicators used to represent collective competence, Cooperation ranked second in terms of factor loadings in both sub-model 1 (Y -> COOP: 0.899) and sub-model 2 (Y -> COOP: 0.862). These results are consistent with the findings of Macke and Crespi (2016), where Cooperation was also ranked second, after Proactivity.

Within the Cooperation construct, two indicators stood out as particularly significant across all the sub-models: COOP_1 (*We pay attention to the moods in our team*) and COOP_4 (*In our team we recognize the efforts of colleagues*). These items emphasize the emotional aspects of Cooperation, highlighting the importance of empathy, emotional intelligence, and mutual recognition in fostering a cooperative team environment, which are factors that have shown to positively impact team performance (Abid et al., 2022; Hwang, 2024). Notably, COOP_1 was also among the main variables found to have a strong link to Cooperation in the study by Macke and Crespi (2016).

**Interpersonal Relationship (IR)**

Interpersonal Relationship was identified as the fourth and final dimension of collective competence based on the instrument to measure collective competences in IT teams developed by Macke and Crespi (2016). Among the four indicators used to represent collective competence, Interpersonal Relationship ranked last in terms of factor loadings in both sub-model 1 (Y -> IR: 0.754) and sub-model 2 (Y -> IR: 0.788) and third for sub-model 3 (Y -> IR: 0.829). These results are consistent with the findings of Macke and Crespi (2016), where Interpersonal Relationship also showed the weakest statistical influence among the dimensions of collective competence.

Within this construct, the indicator IR_1 (*My colleagues understand my strengths and weaknesses*) emerged as the strongest indicator across all three sub-models. This suggests that awareness of individual capabilities within a team plays a key role in shaping perceptions of Interpersonal Relationship. When team members understand each others strengths and weaknesses, it fosters trust and psychologically safety that empowers team members to share their ideas openly (Edmonston, 1999). It also results in better collaborative performance and decision-making (Salas et al., 2015). IR_1 was also identified in the initial study by Macke and Crespi (2016) as a key variable closely linked to Interpersonal Relationship.

#### 5.1.6.1 SUMMARY OF FINDINGS

Overall, the findings align with the existing literature that conceptualizes Collective Competence (Y) through Proactivity, Communication, Cooperation, and Interpersonal Relationship. The study identified several significant indicators within each of these dimensions, validating the constructs as key aspects of collective competence. These indicators are consistent with previously established research. A detailed summary of these findings, including the significant indicators associated with each dimension is presented in Table 5-5 below.

| **Collective Competence (Y)** | | |
|---|---|---|
| **First order construct** | **Significant indicator(s)** | **References to Support Findings** |
| Proactivity (PRO) | PRO_4: When I have problems, my teammates usually help me. | Macke and Crespi (2016) also identified Proactivity as the most significant factor influencing team perceptions about collective competence.<br><br>Agile work practices foster team proactivity, which drives team effectiveness (Junker et al., 2022). Psychologically safe work environments lead to increased proactive behaviour and performance (Messmann, 2023). |
| | PRO_7: My colleagues participate in team decision making with their suggestions. | |
| | PRO_9: In our team colleagues usually share their knowledge. | |
| Communication (COMM) | COMM_1: We recognize a tense situation and talk about it with team members. | Effective communication mechanisms are essential for preventing and managing conflict within teams (Akiner, 2014; Macke & Crespi, 2016; Wu et al., 2017) |
| Cooperation (COOP) | COOP_1: We pay attention to the moods in our team. | COOP_1 was among the main variables found to have a strong link to Cooperation in the study by Macke and Crespi (2016)<br><br>Empathy, emotional intelligence, and mutual recognition are important in fostering a cooperative team environment (Abid et al., 2022; Hwang, 2024). |
| | COOP_4: In our team we recognize the efforts of colleagues. | |
| Interpersonal Relationship (IR) | IR_1: My colleagues understand my strengths and weaknesses. | When team members understand each others strengths and weaknesses, it fosters trust and psychologically safety (Edmonston, 1999). |

Table 5-5: Summary of findings - Collective Competence (Y) through PRO, COMM, COOP, and IR

### 5.1.7 ORGANIZATIONAL COMPETENCE (Z) REPRESENTED THROUGH PEOPLE'S COMPETENCES REQUIREMENTS, PEOPLE'S COMPETENCES STATE, PEOPLE'S COMPETENCES ACQUISITION, AND PEOPLE'S COMPETENCES DEVELOPMENT

This section presents the results regarding the relationships between organizational competence (Z) and its corresponding indicators: People's Competences Requirements (PCR), People's Competences State (PCS), People's Competences Acquisition (PCA) and People's Competences Development (PCD), as examined across the three sub-models. The analysis revealed that all these relationships are strong and statistically significant, with factor loadings greater than 0.6 and t-values greater than 1.96, as summarized in Table 5-6 below.

| | Sub-model 1 | | Sub-model 2 | | Sub-model 3 | |
|---|---|---|---|---|---|---|
| | **Factor Loading (>0.6)** | **T Value (>1.96)** | **Factor Loading (>0.6)** | **T-value (>1.96)** | **Factor Loading (>0.6)** | **T-value (>1.96)** |
| **PCR** | 0.827 | 11.017 | 0.892 | 12.383 | 0.871 | 13.107 |
| **PCS** | 0.752 | 7.198 | 0.787 | 7.701 | 0.793 | 8.774 |
| **PCA** | 0.938 | 11.196 | 0.958 | 11.022 | 0.768 | 8.119 |
| **PCD** | 0.829 | 8.400 | 0.750 | 7.127 | 0.956 | 12.575 |

Table 5-6: Organizational Competence (Z) Indicators - Factor loadings and t-values

**People's Competences Requirements**

In this study, People's Competences Requirements was selected as one of the dimensions of organizational competence, based on the framework provided by the Organisational Competence Baseline for Developing Competence in Managing by Projects (IPMA, 2016). According to the IPMA, this dimension refers to the structured activities led by the HR department to define, place and control the full range of individual competences required for project, programme, and portfolio roles within an organization.

Among the four indicators used to represent organizational competence, People's Competences Requirements ranked second in terms of factor loadings across all sub-models: sub-model 1 (Z -> PCR: 0.827), sub-model 2 (Z -> PCR: 0.892) and sub-model 3 (Z -> PCR: 0.871).

Within the People's Competences Requirements construct, two indicators stood out as particularly significant across all the sub-models: PCR_3 (*The organization provides standards, regulation or guidelines for defining, planning and controlling people's competence requirements*) and PCR_5 (*All project, programme and portfolio managers and staff provide feedback and suggestions for the continuous improvement of people's competence requirements and the respective standard*).

These findings validate the importance of having formalized processes in place for managing competences as well as mechanisms for ongoing feedback and continuous improvement,

especially in project-based organizations. Given the dynamic nature of project staffing, where individuals frequently transition between projects, evaluations at key milestones such as project completion or role reassignment is critical for identifying skill gaps and realigning individual capabilities with organizational needs (Huemann et al., 2007; Turner et al., 2000). Additionally, capturing lessons learned and documenting best practices through internal project management procedures serves as a valuable method for retaining knowledge and enhancing organizational learning (Turner et al., 2000).

**People's Competences State**

People's Competences Requirements was selected as another one of the dimensions of organizational competence, based on the framework provided by the Organisational Competence Baseline for Developing Competence in Managing by Projects (IPMA, 2016). According to the IPMA, this dimension refers to structured activities also led by the HR department to assess and monitor employees' actual competence levels. It focuses on comparing the current state of individual competences against predefined requirements, allowing organizations to identify gaps and areas for development.

Among the four indicators used to represent organizational competence, People's Competences State ranked third in terms of factor loadings across sub-model 2 (Z -> PCS: 0.787) and sub-model 3 (Z -> PCS: 0.793) and was the lowest-ranked in sub-model 1 (Z -> PCS: 0.752). These findings suggest that while People's Competences State is perceived to be less influential than other dimensions in contributing to organizational competence.

Within the People's Competences State construct, PCS_3 (*The organization provides standards, regulations or guidelines for analyzing, identifying and evaluating the state of people's competences*) was consistently the strongest across the three sub-models. These findings highlight the importance of formalized evaluation processes to assess the current competence levels of employees. A structured approach allows the organization to better understand workforce capabilities, identify training needs and support talent development. As noted by Marsick and Watkins (2003), systemic evaluation mechanisms support individual learning as well as the organizational capacity to learn and grow. Similarly, Sense (2007) argues that organizations

committed to continuous learning should integrate reflective and evaluation practices into their project environment to support knowledge development and overall performance.

**People's Competences Acquisition**

People's Competences Acquisition was the third dimension of organizational competence, based on the framework provided by the Organisational Competence Baseline for Developing Competence in Managing by Projects (IPMA, 2016). According to the IPMA, this dimension refers to structured efforts by the HR department to ensure the organization recruits "the right people with the right competences to achieve their project, programme, and portfolio mission, vision and strategy" (IPMA, 2016, p. 57).

Among the four indicators used to represent organizational competence, People's Competences Acquisition ranked highest in terms of factor loadings for sub-model 1 (Z -> PCA: 0.938) and sub-model 2 (Z -> PCA: 0.958). This may suggest that when organizational competence is influenced by individual and collective competence, the acquisition of qualified people is seen as the most important factor. However, People's Competences Acquisition was ranked the lowest-in sub-model 3 (Z -> PCA: 0.768). This shift may suggest that when the direction of influence is reversed (that is, how organizational competence shapes individual and collective competence), competence acquisition may not be seen as sufficient.

Within the People's Competences Acquisition construct, PCA_1 (The organization provides standards for identifying, evaluating, selecting and assigning people (e.g. recruiting assessment centre and job assignments)) was the strongest indicator across the three sub-models. This highlights the importance of having standardized selection processes within an organization to assign individuals to projects, especially in project-based organizations, where assignments are temporary in nature and staffing needs change often. Huemann et al. (2007) proposed a human resource management model tailored to project-based organizations, which supports the maintenance of pools of qualified project personnel. This approach enables organizations to draw from a pre-assessed talent pool, ensuring that individuals with the appropriate competences are assigned to the right projects at the right time.

**People's Competences Development**

People's Competences Development was the fourth and last dimension of organizational competence, based on the framework provided by the Organisational Competence Baseline for Developing Competence in Managing by Projects (IPMA, 2016). According to the IPMA, this dimension involves structured initiatives led by the HR department to support employees' ongoing professional growth.

Among the four dimensions used to represent organizational competence, People's Competences Acquisition showed variation in its relative importance across the three sub-models. In sub-model 1 (Z -> PCD: 0.829), the factor loading was ranked second. However, for sub-model 2, it was the lowest ranked dimension (Z -> PCD: 0.750). Conversely, in sub-model 3, it had the highest factor loading (Z -> PCD: 0.956), suggesting that when the focus is on the impact of organizational competence to collective and individual competence, this dimension is especially important. Within the People's Competences Acquisition construct, PCD_3 (*The organization evaluates the outcomes of people's competences development*) emerged as the strongest indicator across the three sub-models.

Ultimately, these findings support the existing literature that advocate for competence development to be an intentional and embedded component of organizational strategy. This involves structured initiatives such as formal training programs, coaching, mentorship and other developmental activities that align employee skills with the organization's evolving needs (Crawford, 2005; Egginton, 2012; Sense, 2007; Turner et al., 2008). Moreover, the findings highlight the importance of not only providing these learning opportunities but also validating their effectiveness to ensure learning across the organization. This aligns with Marsick and Watkins (2003), who argue that organizational learning requires both individual growth and the capacity of the organization to support and promote that learning. Their framework offers a practical approach for assessing whether learning is taking place at the individual and organizational levels.

#### 5.1.7.1 SUMMARY OF FINDINGS

Overall, the findings align with the existing literature that conceptualizes Organizational Competence (Z) through People's Competences Requirements, People's Competences State, Peoples' Competences Acquisition, and People's Competences Dimension. The study identified several significant indicators within each of these dimensions, validating the constructs as key aspects of organizational competence. These indicators are consistent with previously established research. A detailed summary of these findings, including the significant indicators associated with each dimension is presented in Table 5-7 below.

| **Organizational Competence (Z)** | | |
|---|---|---|
| **First order construct** | **Significant indicator(s)** | **Summary of Findings** |
| People's Competences Requirements (PCR) | PCR_3: The organization provides standards, regulation or guidelines for defining, planning and controlling people's competence requirements. | Project staffing is dynamic as individuals often transition between projects, thus, evaluations at project completion or role reassignment is critical (Huemann et al., 2007; Turner et al., 2000) |
| | PCR_5: All project, programme and portfolio managers and staff provide feedback and suggestions for the continuous improvement of people's competence requirements and the respective standard | Documenting best practices through internal project management procedures serves to retain knowledge and enhance organizational learning (Turner et al., 2000). |
| People's Competences State (PCS) | PCS_3: The organization provides standards, regulations or guidelines for analyzing, identifying and evaluating the state of people's competences | Systemic evaluation mechanisms support individual learning as well as the organizational capacity to learn and grow Marsick and Watkins (2003).<br><br>Organizations should integrate reflective and evaluation practices for knowledge development and overall performance (Sense, 2007). |
| People's Competences Acquisition (PCA) | PCA_1: The organization provides standards for identifying, evaluating, selecting and assigning people (e.g. recruiting assessment centre and job assignments) | HRM model tailored to project-based organizations that supports the maintenance of pools of qualified project personnel to ensure that individuals with the appropriate competences are assigned to the right projects at the right time (Huemann et al., 2007). |
| People's Competence Development (PCD) | PCD_3: The organization evaluates the outcomes of people's competences development | Important for organizations to have structured initiatives such as formal training programs, coaching, mentorship and other developmental activities (Crawford, 2005; Egginton, 2012; Sense, 2007; Turner et al., 2008).<br><br>Organizational learning requires both individual growth and the capacity of the organization to support and promote that learning Marsick and Watkins (2003). |

Table 5-7: Summary of findings - Organizational Competence (Z) through PCR, PCS, PCA, and PCD

## 5.2 THEORETICAL CONTRIBUTIONS

This study makes three important theoretical contributions to the field of project management competence.

First, as an exploratory study, it provides a starting point for validating the bidirectional relationships among the individual, collective and organizational levels of competence. As revealed in the bibliometric analysis in Section 1.2.1, much of the existing research has primarily focused on the individual level and is often focused on the role of project manager. This study demonstrates that competence is a construct shaped by influences across different levels of competence. By providing empirical evidence of these interconnections, the research advances the theoretical understanding of competence within project-based environments, which is also shaped by collective competence and organizational competence (Ruuska & Teigland, 2009; Ruuska & Vartiainen, 2003).

Second, this study addresses a significant gap in the literature by adopting a multilevel lens to the study of project management competence. Previous research has largely examined competence at the individual level, overlooking the broader context in which individuals and teams operate. By explicitly examining the relationships across individual, collective, and organizational competence, this research broadens the scope of existing competence frameworks and supports existing multilevel perspectives, including those proposed by Wiewiora et al. (2019) and Melkonian and Picq (2011). Overall, a multilevel approach offers a richer and more comprehensive perspective of how project success is influenced, not only by individual capabilities, but also by team dynamics and organizational systems. This study responds directly to researchers such as Geraldi and Soderlund (2018) and Loufrani-Fedida and Missonier (2015), who have advocated for multi-level analysis in project research.

Lastly, this study introduces a comprehensive multilevel framework for understanding project management competences. By drawing on insights from a broad range of industries and incorporating the experiences of practitioners across different roles and career stages, the framework captures the complexity of real-world project environments. Notably, the study advances a more inclusive understanding of project management competence by extending beyond the traditional focus on project managers. It acknowledges that successful project outcomes also

rely on the competence of various types of practitioners, including team members and organizational actors involved throughout the project lifecycle. Ultimately, it supports the arguments of Loufrani-Fedida and Missonier (2015) and Napier et al. (2009), who challenge the notion that the project manager alone is responsible for the outcome of the project.

## 5.3 PRACTICAL CONTRIBUTIONS

This study offers four practical insights for project-based organizations seeking to improve project outcomes through a more comprehensive approach to competence development.

First, traditionally, the emphasis in project management has been on individual competence, particularly that of the project manager. However, the findings of this research highlight the importance of understanding how individual, collective, and organizational competence are interconnected and mutually reinforcing. Recognizing these relationships can help shift the organizational focus towards a more comprehensive view of project success, one that acknowledges the critical role of teams and organizational systems alongside individual capabilities.

Second, as a result, organizations should broaden their competence development strategies. In addition to supporting individual skill building, they should allocate resources to strengthen team-level collaboration and build supportive organizational structures. This includes fostering a culture of continuous learning, collaborative leadership practices, and implementing policies and procedures that support team collaboration and organizational learning. By investing in all competence levels, organizations can create an environment that fosters competence at all levels, resulting in more consistent and successful project delivery.

Third, these findings provide an opportunity to rethink traditional performance evaluation systems. Rather than focusing solely on individual competence, organizations should integrate assessment of team collaboration and organizational contributions into their evaluation frameworks. This multilevel approach would incentivize behaviours that not only enhance personal performance but that also recognizes the value of teamwork, shared responsibility, and system-level thinking in project environments.

Finally, the study highlights the importance of organizations to invest in structures and policies that not only attract competent individuals and teams but also foster their development throughout their careers. Equally important is empowering these individuals and teams to actively contribute to organizational improvement, for example by providing feedback on policies and processes. This approach ensures that competence is growing both from a top-down and bottom-up approach. By enabling individuals to influence their work environment and by maintaining a culture that values growth at every level, organizations can sustain a continuous organization-wide cycle of competence development.

## 5.4 LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

While this study provides valuable insights into the relationship between individual, collective, and organizational competence, it is important to acknowledge several limitations that may impact the interpretation and ability to generalize the findings. Table 5-8 below presents a summary of these limitations as well as opportunities for future research.

First, the discriminant validity across all three sub-models for the first order constructs was not satisfactory. This limitation suggests that some constructs may overlap conceptually, indicating a potential lack of clarity or distinction in the competence dimensions under investigation. This overlap may have influenced the reliability of the measurement model. Future studies should consider refining or revalidating the constructs to ensure greater distinction among the constructs.

Second, the sample size and demographics may pose limitations. As an exploratory study, the research relied on a relatively small sample size (N=101), drawn primarily from the IT and government sectors (accounting for 48% of respondents combined). While this may provide initial insight into project-based environments, the sample may not adequately represent the full range of project contexts across industries, geographies, or organizational types. Future research should aim to expand the sample base to include participants from diverse backgrounds, from a wide variety of sectors, organizational sizes and cultural settings. Additionally, comparative sub-group analysis to examine the differences across job roles, sectors or levels of experience, could provide more nuanced insights into competence development across diverse project settings.

A third limitation is that the study relied on self-reported survey data, which captures the notion of competence from the subjective perception of the respondent. While this method offers valuable insights into individual experiences and reflections, these perceptions are susceptible to bias and can be influenced by demographic factors, such as age, experience or role, potentially affecting how questions are interpreted and answered. Future research could benefit from adopting mixed methods approaches, such as incorporating objective performance data, to validate self-reported measures.

Fourth, the scope of the study was intentionally limited to a subset of constructs at each competence level to ensure feasibility in survey design and analysis. While this approach was necessary for managing the research scope, it limits the ability to generalize the findings across the broader range of constructs within the theoretical framework. Additionally, the research was limited to three defined levels of competence: individual, collective (project team) and organizational. Future research could extend the multilevel framework to examine additional layers such as inter-team (program or portfolio level) or inter-organizational collaboration, which are increasingly relevant in complex project environments.

Fifth, the scope of the study was also deliberately limited to examining singular associations between variables rather than exploring the combined relationships among the three levels of competence. Given the complexity involved in interpreting multiple interconnected variables, this research focused on examining the correlation between pairs of variables to better isolate and understand the influence of each variable. Future research should aim to explore the interconnectedness among the different levels of competence. The framework proposed by Loufrani-Fedida and Missonier (2015), discussed in Section 2.5.7 , offers a good starting point for this, as it examines the combined influence of organizational and individual competencies in shaping collective competences.

Finally, although this study identified reciprocal relationships between the competence levels, it did not explicitly test or measure any mechanisms through which these relationships may be enabled. Existing literature, particularly Wiewiora et al. (2019), highlights the importance of bridging mechanisms, such as shared mental models, networks, feedback, leadership style, organizational culture, and internal political dynamics, as key enablers of knowledge transfer

across the individual, collective, and organizational levels. While these mechanisms were valuable references to help interpret differences in relationship strengths, they were not empirically tested. Future research should seek to empirically examine the mediating or moderating roles of these contextual factors to better understand the conditions that facilitate or hinder competence development across levels. In addition, longitudinal research designs could offer valuable insights into how these relationships evolve over time, particularly in response to organizational change or project lifecycle changes.

| # | **Study Limitations** | **Opportunities for Future Research** |
|---|---|---|
| 1 | The discriminant validity across all three sub-models for the first order constructs was not satisfactory. | Consider refining or revalidating the constructs to ensure greater distinction among the constructs. |
| 2 | Relied on a relatively small sample size, drawn primarily from the IT and government sectors. | Expand the sample base to include participants from diverse backgrounds and carry out comparative sub-group analysis. |
| 3 | Relied on self-reported survey data. | Adopt mixed methods approaches. |
| 4 | Scope was limited to a subset of constructs at each competence level and to three defined levels of competence: individual, collective (project team) and organizational. | Extend the multilevel framework to examine additional layers of competence. |
| 5 | Scope was limited to singular associations between variables rather than interpreting multiple interconnected variables. | Future research should aim to explore the interconnectedness among a combination of different levels of competence. |
| 6 | Did not explicitly test or measure any mechanisms through which the relationships across competence levels are enabled. | Examine the mediating or moderating roles of contextual factors and carry out longitudinal research to better understand how the relationships across competence levels evolve over time. |

Table 5-8: Summary of study limitations and opportunities for future research

## 5.5 GENERAL CONCLUSION

The aim of this study was to explore how project management competence is shaped using a multilevel approach that goes beyond individual competence. Drawing on a multilevel framework and using empirical data from 101 project practitioners, the findings provided strong support for the idea the competence is shaped through dynamic and reciprocal relationships across the individual, collective and organizational levels of the project environment.

Specifically, the results demonstrated strong, positive, and bidirectional relationships across all three levels of competence, with the strongest connection observed between the individual and collective levels. This suggests that team dynamics and close collaboration provide the most immediate and visible feedback loops for competence development. In contrast, the relationships involving the organizational level were weaker, likely due to their more abstract, systemic nature and the indirect influence of contextual factors such as organizational structures, leadership and culture.

These findings extend current project management literature by providing empirical evidence of the multilevel nature of competence and by highlighting the interdependence between individuals, teams and the broader organization. The study also reinforces the importance of these bidirectional connections, which suggest that competence is continuously shaped through mutual influence. Individual competence both contributes to and is reinforced by the competence of the project team. Likewise, both individual and collective competence are influenced by, and help shape the organization's systems, structures and culture. This interconnectedness highlights the importance of adopting a more integrated and systemic approach to competence development in project environments. From a practical perspective, the study calls for project-based organizations to adopt more integrated and systemic approaches to competence development.

While the research offers valuable theoretical and practical insights, it also acknowledges several limitations including discriminant validity concerns, reliance on self-reported data, and a limited sample scope. These limitations provide opportunities for future research, which could build on this study by expanding participant diversity, exploring additional levels of constructs within the competence framework, incorporating different types of research methods, and including contextual factors as mediating constructs.

## APPENDIX 1: THESAURUS FILE USED FOR BIBLIOMETRIC ANALYSIS IN VOSVIEWER

| LABEL | REPLACE BY |
|---|---|
| competence | competences |
| competency | competences |
| competencies | competences |
| competencie | competences |
| project management competencies | competences |
| project management competence | competences |
| project manager competencies | competences |
| construction project | construction |
| construction industry | construction |
| construction management | construction |
| construction projects | construction |
| construction project management | construction |
| hrm | human resource management |
| success factors | critical success factors |
| education | higher education |
| success | project success |
| projects | project management |
| project | project management |
| managing projects | project management |
| information systems | information technology |
| project managers | project manager |
| sustainable development | sustainability |
| skill | skills |

Table 5-9: Thesaurus file used for bibliometric analysis in VOSviewer

## APPENDIX 2: BIBLIOMETRIC ANALYSIS CLUSTERS, KEYWORDS, AND THEMES

| CLUSTER 1 (RED) | | CLUSTER 2 (GREEN) | | CLUSTER 3 (BLUE) | | CLUSTER 4 (YELLOW) | | CLUSTER 5 (PURPLE) | |
|---|---|---|---|---|---|---|---|---|---|
| **Keyword** | **Occurrence** | **Keyword** | **Occurrence** | **Keyword** | **Occurrence** | **Keyword** | **Occurrence** | **Keyword** | **Occurrence** |
| competences | 192 | construction | 104 | project management | 354 | skills | 24 | project manager | 53 |
| learning | 16 | higher education | 30 | critical success factors | 35 | engineering education | 17 | project success | 41 |
| performance | 15 | innovation | 18 | knowledge management | 27 | soft skills | 17 | leadership | 37 |
| project-based learning | 15 | project performance | 15 | change management | 11 | training | 17 | emotional intelligence | 20 |
| sustainability | 15 | collaboration | 14 | risk management | 11 | developing countries | 12 | information technology | 18 |
| human resource management | 13 | trust | 12 | governance | 8 | management | 11 | ahp | 6 |
| decision-making | 11 | communication | 11 | knowledge transfer | 8 | evaluation | 9 | artificial intelligence | 6 |
| agile | 9 | factor analysis | 8 | thailand | 6 | assessment | 8 | complexity | 5 |
| china | 9 | case study | 7 | competence development | 5 | professional development | 8 | ipma | 5 |
| simulation | 9 | quality improvement | 7 | managing and leading | 5 | knowledge | 7 | new product development | 5 |
| capabilities | 8 | design management | 6 | productivity | 5 | employability | 6 | public sector | 5 |
| teamwork | 8 | experiential learning | 6 | project planning | 5 | ghana | 5 | | |
| competence management | 7 | product development | 6 | united kingdom | 5 | | | | |
| development | 7 | project team | 6 | | | | | | |
| malaysia | 7 | creativity | 5 | | | | | | |
| procurement | 7 | vietnam | 5 | | | | | | |
| questionnaire survey | 7 | | | | | | | | |
| active learning | 6 | | | | | | | | |

| CLUSTER 1 (RED) | | CLUSTER 2 (GREEN) | | CLUSTER 3 (BLUE) | | CLUSTER 4 (YELLOW) | | CLUSTER 5 (PURPLE) | |
|---|---|---|---|---|---|---|---|---|---|
| post-disaster reconstruction | 6 | | | | | | | | |
| indonesia | 5 | | | | | | | | |
| professionalism | 5 | | | | | | | | |
| scrum | 5 | | | | | | | | |

| LEGEND | Theme 1: Types of competences | | Theme 2: How competences are shaped | |
|---|---|---|---|---|

## APPENDIX 3: SURVEY

| **PARTICIPANT PROFILE** | **CARACTÉRISTIQUES DU RÉPONDANT** |
|---|---|
| Before starting the survey, please take a moment to provide some information about yourself. | Avant de commencer le sondage, veuillez prendre un moment pour fournir quelques informations sur vous. |
| **What is your gender?**<br>• Female<br>• Male<br>• Non-Binary<br>• Other | **Quel est votre genre?**<br>• Femme<br>• Homme<br>• Non-Binaire<br>• Autre |
| **What is your age?**<br>• 18-24 years old<br>• 25-34 years old<br>• 35-44 years old<br>• 45-55 years old<br>• 55+ years old | **Quel âge avez-vous?**<br>• 18-24 ans<br>• 25-34 ans<br>• 35-44 ans<br>• 45-54 ans<br>• 55+ ans |
| **What is your highest level of education?**<br>• High school not completed<br>• High school diploma or equivalent<br>• Post-secondary diploma<br>• Undergraduate degree<br>• Master's degree<br>• Doctoral degree or higher | **Quel est votre plus haut niveau de scolarité?**<br>• Secondaire non complété<br>• Diplôme d'études secondaires ou équivalent<br>• Diplôme postsecondaire<br>• Baccalauréat<br>• Maîtrise<br>• Doctorat ou niveau supérieur |
| **What level of project management experience do you have?**<br>• **Novice** *(I am just starting out in project management and often face a given problem and a given situation for the first time.)*<br>• **Advanced Beginner** *(I have gained some real-life project management experience. I am learning to recognize relevant elements in relevant situations based on previous experience.)*<br>• **Competent Practitioner** *(I have gained a considerable amount of experience in project management and the number of recognizable and learned elements is now overwhelming. I can use my own judgement to deliberate about the consequences in specific situations.)*<br>• **Proficient Practitioner** *(I have moved away from analytical problem-solving only and now use interpretation and judgement in decision-making. I understand situations based on prior* | **Quel est votre niveau d'expérience en gestion de projet?**<br>• **Novice** *(Je débute en gestion de projet et je suis souvent confronté à un problème ou à une situation pour la première fois.)*<br>• **Débutant avancé** *(J'ai acquis une certaine expérience pratique en gestion de projet. J'apprends à reconnaître les éléments pertinents dans des situations pertinentes en me basant sur mes expériences passées.)*<br>• **Practicien competent** *(J'ai acquis une expérience considérable en gestion de projet et le nombre d'éléments reconnaissables et appris est désormais vaste. Je peux utiliser mon propre jugement pour réfléchir aux conséquences dans des situations spécifiques.)*<br>• **Practicien accompli** *(Je me suis éloigné de la résolution analytique des problèmes et j'utilise désormais l'interprétation et le jugement dans la prise de décision. Je comprends les situations en* |

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| *actions and experience. I understand and participate in power relations.)*<br><br>• **Expert** *(I am a reflective learner capable of simultaneous thinking and doing. I am capable of critical reflection of myself and the group. I consider the present and deliberate about the future.)* | *fonction des actions et expériences passées. Je comprends et participe aux relations de pouvoir.)*<br><br>• **Expert** *(Je suis un apprenant réfléchi capable de penser et d'agir simultanément. Je suis capable de réfléchir de manière critique sur moi-même et sur le groupe. Je considère le présent et réfléchis au futur.)* |
| **In what industry are you currently working in?**<br>• Healthcare and Life Sciences<br>• Information Technology and Software<br>• Education and Training<br>• Construction and Engineering<br>• Manufacturing and Industrial Production<br>• Retail and Consumer Goods<br>• Financial Services and Banking<br>• Energy and Utilities<br>• Non-Profit and Social Services<br>• Transportation and Logistics<br>• Government and Public Sector<br>• Environmental and Sustainability Services<br>• Other | **Dans quel secteur travaillez-vous actuellement?**<br>• Santé et sciences de la vie<br>• Technologies de l'information et logiciels<br>• Éducation et formation<br>• Construction et ingénierie<br>• Fabrication et production industrielle<br>• Commerce de détail et biens de consommation<br>• Services financiers et bancaires<br>• Énergie et services publics<br>• Organismes à but non lucratif et services sociaux<br>• Transport et logistique<br>• Secteur public et gouvernement<br>• Services environnementaux et de durabilité<br>• Autre |
| **CONSIDER A SPECIFIC PROJECT** | **CONSIDÉREZ UN PROJET SPÉCIFIQUE** |
| For this survey, we ask that you concentrate on a specific project - either a current project you are actively working on or a project you completed within the past two years. All survey questions should be answered with this chosen project in mind, allowing for a focused and consistent perspective throughout your responses. | Pour ce sondage, nous vous demandons de vous concentrer sur un projet spécifique – soit un projet en cours sur lequel vous travaillez activement, soit un projet que vous avez complété au cours des deux dernières années. Toutes les questions du sondage doivent être répondues en tenant compte de ce projet choisi, afin d'assurer une perspective claire et cohérente tout au long de vos réponses. |
| **What best describes the type of project you have selected?**<br>• Administrative<br>• Construction<br>• Computer Software Development<br>• Design of Plans<br>• Maintenance of Process Industries<br>• Event or Relocation<br>• Equipment or System Installation<br>• New Product Development<br>• Research<br>• Other | **Qu'est-ce qui décrit le mieux le type de projet que vous avez sélectionné?**<br>• Administratif<br>• Construction<br>• Développement de logiciels informatiques<br>• Conception de plans<br>• Maintenance des industries de procédé<br>• Événement ou déménagement<br>• Installation d'un équipement ou d'un système<br>• Développement de nouveaux produits<br>• Recherche<br>• Autre |
| **What best describes the complexity of the project you have selected?**<br>• Low<br>• Medium<br>• High | **Qu'est-ce qui décrit le mieux la complexité du projet que vous avez sélectionné?**<br>• Faible<br>• Moyen<br>• Élevé |

| **What best describes your role in the project you have selected?**<br>• Project Sponsor<br>• Project Director<br>• Project Manager<br>• Project Team Member<br>• Other | **Quel rôle décrit le mieux votre fonction dans le projet que vous avez sélectionné?**<br>• Sponsor de projet<br>• Directeur de projet<br>• Chef de projet<br>• Membre de l'équipe de projet<br>• Autre |
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For questions 1-54, the following LIKERT scale is provided for responses.

Pour les questions 1 à 54, l'échelle de LIKERT suivante est proposée pour répondre aux questions.

| **LIKERT SCALE 1-7** | **Échelle de mesure Likert 1-7** |
|---|---|
| Strongly Disagree | Tout à fait en désaccord |
| Disagree | En désaccord |
| Slightly Disagree | Légèrement en désaccord |
| Neutral | Neutre |
| Slightly Agree | Légèrement d'accord |
| Agree | D'accord |
| Strongly Agree | Tout à fait d'accord |

| **INDIVIDUAL COMPETENCE** | **COMPÉTENCE INDIVIDUELLE** |
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| Considering the project you have selected, the following questions are intended to assess your INDIVIDUAL COMPETENCE in teamwork, communication, and relationship-building within the context of this project. | En tenant compte du projet que vous avez sélectionné, les questions suivantes ont pour but d'évaluer votre COMPÉTENCE INDIVIDUELLE en travail d'équipe, communication et création de relations dans le cadre de ce projet. |
| **How much do you agree or disagree with the following statements related to your TEAMWORK skills?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant vos compétences en TRAVAIL D'ÉQUIPE?** |
| 1. I select the right team members to build a productive team, which includes:<br><br>- Considering individual competences, strengths, weaknesses and motivation when deciding on team inclusion, roles and tasks;<br>- Clarifying objectives and creating a common vision;<br>- Setting the team objectives, agenda and completion criteria;<br>- Negotiating common team norms and rules; and | 1. Je sélectionne les bons membres de l'équipe pour constituer une équipe productive, ce qui inclut :<br><br>-Prendre en compte les compétences individuelles, les forces, les faiblesses et la motivation lors de la décision d'inclusion dans l'équipe, des rôles et des tâches;<br>-Clarifier les objectifs et créer une vision commune;<br>-Définir les objectifs de l'équipe, l'agenda et les critères d'achèvement; |

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| - Motivating individuals and building team awareness. | -Négocier des normes et des règles communes au sein de l'équipe; et<br>-Motiver les individus et développer la conscience collective de l'équipe. |
| 2. I promote cooperation and networking between team members, which includes:<br><br>- Creating opportunities for team member discussions;<br>- Asking for opinions, suggestions and concerns from team members in order to improve performance;<br>- Sharing successes with the team(s);<br>- Promoting cooperation with people both within and outside the team;<br>- Taking appropriate action when team cooperation is threatened; and<br>- Using tools for collaboration. | 2. Je promeus la coopération et le réseautage entre les membres de l'équipe, ce qui inclut :<br><br>-Créer des opportunités de discussions entre les membres de l'équipe;<br>-Solliciter les opinions, suggestions et préoccupations des membres de l'équipe pour améliorer la performance;<br>-Partager les succès avec l'équipe ou les équipes;<br>-Promouvoir la coopération avec des personnes à l'intérieur et à l'extérieur de l'équipe;<br>-Prendre des mesures appropriées lorsque la coopération au sein de l'équipe est menacée;<br>-Utiliser des outils de collaboration. |
| 3. I support, facilitate and review the development of the team and its members, which includes:<br><br>- Promoting continuous learning and knowledge sharing;<br>- Using techniques to engage in development (e.g. on-the-job training);<br>- Providing opportunities for seminars and workshops (on-and off-the-job);<br>- Planning and promoting "lessons learned" sessions; and<br>- Providing time and opportunity for self-development of team members. | 3. Je soutiens, facilite et évalue le développement de l'équipe et de ses membres, ce qui inclut :<br><br>-Promouvoir l'apprentissage continu et le partage des connaissances;<br>-Utiliser des techniques pour favoriser le développement (par exemple, la formation en cours d'emploi);<br>-Offrir des opportunités de séminaires et d'ateliers (en entreprise et en dehors);<br>-Planifier et promouvoir des séances de "leçons apprises"; et<br>-Accorder du temps et des opportunités pour le développement personnel des membres de l'équipe. |
| 4. I empower teams by delegating tasks and responsibilities, which includes:<br><br>- Delegating tasks when and where appropriate;<br>- Empowering people and teams by delegating responsibility;<br>- Clarifying performance criteria and expectations;<br>- Providing reporting structures at team level; and<br>- Providing individual and team feedback sessions. | 4. Je responsabilise les équipes en délégant des tâches et des responsabilités, ce qui inclut :<br><br>-Déléguer des tâches lorsque et où cela est approprié;<br>-Responsabiliser les individus et les équipes en déléguant des responsabilités;<br>-Clarifier les critères de performance et les attentes;<br>-Mettre en place des structures de rapport au niveau de l'équipe; et<br>-Organiser des séances de retour d'information individuelles et collectives. |
| 5. I recognize errors to facilitate learning from mistakes, which includes:<br><br>- As far as possible, avoiding negative effects of errors on project success;<br>- Realizing that mistakes happen and accepting that people make mistakes;<br>- Showing tolerance for mistakes;<br>- Analyzing and discussing mistakes to determine improvements in processes; and<br>- Helping team members to learn from their mistakes. | 5. Je reconnais les erreurs afin de faciliter l'apprentissage à partir de celles-ci, ce qui inclut :<br><br>-Dans la mesure du possible, éviter les effets négatifs des erreurs sur le succès du projet;<br>-Reconnaître que les erreurs arrivent et accepter que les individus peuvent en commettre;<br>-Faire preuve de tolérance envers les erreurs;<br>-Analyser et discuter des erreurs pour identifier des améliorations dans les processus; et |

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| | -Aider les membres de l'équipe à tirer des enseignements de leurs erreurs. |
| **How much do you agree or disagree with the following statements related to your COMMUNICATION skills?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant vos compétences en COMMUNICATION?** |
| 6. I provide clear and structured information to others and verify their understanding, which includes:<br><br>- As far as possible, avoiding negative effects of errors on project success;<br>- Structuring information logically depending on the audience and the situation;<br>- Considering using story-telling when appropriate;<br>- Using language that is easy to understand;<br>- Delivering public speaking and presentations;<br>- Coaching and giving training;<br>- Leading and facilitating meetings; and<br>- Using visualization, body language and intonation to support and emphasize messages. | 6. Je fournis des informations claires et structurées aux autres et vérifie leur compréhension, ce qui inclut :<br><br>-Dans la mesure du possible, éviter les effets négatifs des erreurs sur le succès du projet;<br>-Structurer les informations de manière logique en fonction du public et de la situation;<br>-Envisager d'utiliser la narration lorsque cela est approprié;<br>-Employer un langage facile à comprendre;<br>-Faire des discours publics et des présentations;<br>-Encadrer et dispenser des formations;<br>-Animer et faciliter des réunions; et<br>-Utiliser la visualisation, le langage corporel et l'intonation pour soutenir et mettre en valeur les messages. |
| 7. I facilitate and promote open communication, which includes:<br><br>- Structuring information logically depending on the audience and the situation;<br>- Creating an open and respectul atmosphere;<br>- Listening actively and patiently by confirming what has been heard, re-stating or paraphrasing the speaker's own words and confirming understanding;<br>- Not interrupting or starting to talk while others are talking;<br>- Open and showing true interest in new ideas;<br>- Confirming message/information is understood or, when needed, asking for clarification, examples and/or details;<br>- Making clear when, where, and how ideas, emotions and opinions are welcome; and<br>- Making clear how ideas and opinions will be treated. | 7. Je facilite et promeus une communication ouverte, ce qui inclut :<br><br>-Structurer les informations de manière logique en fonction du public et de la situation;<br>-Créer une atmosphère ouverte et respectueuse;<br>-Écouter activement et patiemment en confirmant ce qui a été entendu, en reformulant ou paraphrasant les propos de l'interlocuteur et en confirmant la compréhension;<br>-Ne pas interrompre ou commencer à parler pendant que d'autres parlent;<br>-Être ouvert et montrer un véritable intérêt pour les nouvelles idées;<br>-Confirmer que le message ou l'information sont bien compris ou, si nécessaire, demander des clarifications, des exemples et/ou des détails;<br>-Clarifier quand, où et comment les idées, émotions et opinions sont les bienvenues; et<br>-Préciser comment les idées et les opinions seront traitées. |
| 8. I choose communication styles and channels to meet the needs of the audience, situation and management level, which includes:<br><br>- Creating an open and respectful atmosphere;<br>- Selecting appropriate communication channels and style depending on the target audience;<br>- Communicating via selected channels according to the selected style; | 8. Je choisis les styles et canaux de communication pour répondre aux besoins du public, de la situation et du niveau de gestion, ce qui inclut :<br><br>-Créer une atmosphère ouverte et respectueuse;<br>-Sélectionner les canaux et le style de communication appropriés en fonction du public cible;<br>-Communiquer via les canaux choisis selon le style sélectionné; |

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| - Monitoring and controlling communication; and<br>- Changing the communication channels and style depending on the situation. | -Surveiller et contrôler la communication; et<br>-Adapter les canaux et le style de communication en fonction de la situation. |
| 9. I communicate effectively with virtual teams, which includes:<br><br>- Using modern communication technology, (e.g. webinars, tele-conferences, chat, cloud computing); and<br>- Defining and maintaining clear communication processes and procedures;<br>- Promoting cohesion and team building. | 9. Je communique efficacement avec des équipes virtuelles, ce qui inclut :<br><br>-Utiliser des technologies de communication modernes (par exemple, webinaires, téléconférences, chat, informatique en nuage);<br>-Définir et maintenir des processus et des procédures de communication clairs; et<br>-Promouvoir la cohésion et le travail d'équipe. |
| 10. I employ humour and sense of perspective when appropriate, which includes:<br><br>- Changing communication perspectives; and<br>- Decreasing tension by use of humour. | 10. J'utilise l'humour et le sens de la perspective lorsque cela est approprié, ce qui inclut :<br><br>-Changer de perspective de communication; et<br>-Réduire la tension par l'utilisation de l'humour. |
| **How much do you agree or disagree with the following statements related to your <u>RELATIONSHIP AND ENGAGEMENT</u> skills?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant vos compétences en <u>RELATION ET ENGAGEMENT</u>?** |
| 11. I initiate and develop personal and professional relationships, which includes:<br><br>- Actively seeking possibilities and situations to make new contacts;<br>- Using humour as an icebreaker;<br>- Present, available and open for dialogue;<br>- Staying actively in contact, establishing a routine for bilateral meetings; and<br>- Keeping others informed. | 11. J'initie et développe des relations personnelles et professionnelles, ce qui inclut :<br><br>-Rechercher activement des opportunités et des situations pour établir de nouveaux contacts;<br>-Utiliser l'humour comme brise-glace;<br>-Être présent, disponible et ouvert au dialogue;<br>-Maintenir un contact actif en établissant une routine de réunions bilatérales; et<br>-Tenir les autres informés. |
| 12. I build, facilitate and contribute to social networks, which includes:<br><br>- Joining and contributing to social networks;<br>- Creating and facilitating social networks;<br>- Organizing events for networking; and<br>- Facilitating support for networking. | 12. Je construis, facilite et contribue à des réseaux sociaux, ce qui inclut :<br><br>-Rejoindre et contribuer à des réseaux sociaux;<br>-Créer et faciliter des réseaux sociaux;<br>-Organiser des événements de réseautage;<br>-Faciliter le soutien au réseautage. |
| 13. I demonstrate empathy through listening, understanding and support, which includes:<br><br>- Listening actively;<br>- Making others feel heard;<br>- Asking questions for clarification;<br>- Relating to the problems of others and offering help;<br>- Familiarizing with the values and standards of others; and<br>- Responding to communication within a reasonable time. | 13. Je fais preuve d'empathie en écoutant, en comprenant et en soutenant, ce qui inclut :<br><br>-Écouter activement;<br>-Faire en sorte que les autres se sentent écoutés;<br>-Poser des questions pour clarifier;<br>-M'identifier aux problèmes des autres et offrir de l'aide;<br>-Me familiariser avec les valeurs et les normes des autres; et |

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| | -Répondre aux communications dans un délai raisonnable. |
| 14. I show confidence and respect by encouraging others to share their opinions or concerns, which includes:<br><br>- Relying on a given word;<br>- Assigning tasks to team members based on confidence;<br>- Expecting others to act according to common values and agreements;<br>- Delegating work without monitoring and controlling every step;<br>- Asking others for their ideas, wishes and concerns;<br>- Noticing and respecting differences between people; and<br>- Embracing the importance of professional and personal variety. | 14. Je montre de la confiance et du respect en encourageant les autres à partager leurs opinions ou préoccupations, ce qui inclut :<br><br>-Se fier à une parole donnée;<br>-Attribuer des tâches aux membres de l'équipe en fonction de la confiance accordée;<br>-Attendre des autres qu'ils agissent selon des valeurs et des accords communs;<br>-Déléguer le travail sans surveiller ou contrôler chaque étape;<br>-Demander aux autres leurs idées, souhaits et préoccupations;<br>-Remarquer et respecter les différences entre les personnes; et<br>-Valoriser l'importance de la diversité professionnelle et personnelle. |
| 15. I share my own vision and goals in order to gain the engagement and commitment of others, which includes:<br><br>- Acting positively;<br>- Clearly communicating vision, goals and outcomes;<br>- Inviting debate and critique of the vision, goals and outcomes;<br>- Involving people in planning and decision-making;<br>- Asking for commitment on specific tasks;<br>- Taking individual contributions seriously; and<br>- Emphasizing the commitment of all to realize success. | 15. Je partage ma propre vision et mes objectifs afin d'obtenir l'engagement et l'implication des autres, ce qui inclut :<br><br>-Agir de manière positive;<br>-Communiquer clairement la vision, les objectifs et les résultats;<br>-Inviter au débat et à la critique sur la vision, les objectifs et les résultats;<br>-Impliquer les personnes dans la planification et la prise de décision;<br>-Demander un engagement sur des tâches spécifiques;<br>-Prendre les contributions individuelles au sérieux; et<br>-Mettre l'accent sur l'engagement de tous pour atteindre le succès. |
| **COLLECTIVE COMPETENCE** | **COMPÉTENCE COLLECTIVE** |
| Considering the project you have selected, the following questions are intended to assess the PROJECT TEAM'S COMPETENCE in proactivity, communication, cooperation and relationship-building within the context of this project. | Compte tenu du projet que vous avez sélectionné, les questions suivantes ont pour objectif d'évaluer la COMPÉTENCE DE L'ÉQUIPE DU PROJET en matière de proactivité, communication, coopération et développement des relations dans le cadre de ce projet. |
| **How much do you agree or disagree with the following statements related to the project team's PROACTIVITY?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant la PROACTIVITÉ de l'équipe projet?** |
| 16. Our team often finds creative ways to solve problems. | 16. Notre équipe trouve souvent des moyens créatifs pour résoudre les problèmes. |
| 17. My colleagues often cooperate so that the team can achieve their goals. | 17. Mes collègues coopèrent souvent pour que l'équipe puisse atteindre ses objectifs. |

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| 18. Our team tries to have good relationships with other teams. | 18. Notre équipe essaie d'avoir de bonnes relations avec les autres équipes. |
| 19. When I have problems, my teammates usually help me. | 19. Lorsque j'ai des problèmes, mes coéquipiers m'aident généralement. |
| 20. When a problem hinders our progress, team members show motivation to solve it. | 20. Lorsqu'un problème entrave notre progression, les membres de l'équipe se montre motivés pour le résoudre. |
| 21. In our team, people are interested in learning more about their colleagues. | 21. Dans notre équipe, les gens veulent en savoir plus sur leurs collègues. |
| 22. My colleagues participate in team decision making with their suggestions. | 22. Mes collègues participent à la prise de décision de l'équipe avec leurs suggestions. |
| 23. In our team, there is a balanced distribution of tasks among members. | 23. Dans notre équipe, il y a une répartition équilibrée des tâches entre les membres. |
| 24. In our team colleagues usually share their knowledge. | 24. Dans notre équipe, les collègues partagent généralement leurs connaissances. |
| **How much do you agree or disagree with the following statements related to the project team's <u>COMMUNICATION</u>?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant la <u>COMMUNICATION</u> de l'équipe du projet?** |
| 25. In our team, we tell colleagues if they are doing something considered unacceptable. | 25. Dans notre équipe, nous informons nos collègues s'ils font quelque chose considéré comme inacceptable. |
| 26. We recognize a tense situation and talk about it with team members. | 26. Nous reconnaissons une situation tendue et en parlons avec les membres de l'équipe. |
| 27. We often discuss how to deal with everyday difficulties. | 27. Nous discutons souvent de la façon de faire face aux difficultés quotidiennes. |
| How much do you agree or disagree with the following statements related to the project team's <u>COOPERATION</u>? | Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant la <u>COOPÉRATION</u> de l'équipe du projet? |
| 28. We pay attention to the moods in our team. | 28. Nous sommes attentifs aux humeurs de notre équipe. |
| 29. My colleagues have ways to show they care about each other. | 29. Mes collègues ont des moyens de montrer qu'ils se soucient les uns des autres. |
| 30. Relationships in our team are based on cooperation. | 30. Les relations au sein de notre équipe sont basées sur la coopération. |
| 31. In our team we recognize the efforts of colleagues. | 31. Dans notre équipe, nous reconnaissons les efforts de nos collègues. |

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| **How much do you agree or disagree with the following statements related to the project team's INTERPERSONAL RELATIONSHIP?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant les RELATIONS INTERPERSONNELLES de l'équipe du projet?** |
| 32. My colleagues understand my strengths and weaknesses. | 32. Mes collègues comprennent mes forces et mes faiblesses. |
| 33. When I have a complaint, I feel free to talk to a colleague(s) about it. | 33. Lorsque j'ai une plainte, je me sens libre d'en parler à un ou plusieurs collègues. |
| 34. My colleagues encourage me to meet or exceed my personal and professional goals. | 34. Mes collègues m'encouragent à atteindre ou à dépasser mes objectifs personnels et professionnels. |
| **ORGANIZATIONAL COMPETENCE** | **COMPÉTENCE ORGANISATIONNELLE** |
| Considering the project you have selected, the following questions are intended to assess the PEOPLE COMPETENCES OF THE ORGANIZATION where this project was carried out. | Compte tenu du projet que vous avez sélectionné, les questions suivantes ont pour objectif d'évaluer les COMPÉTENCES DES PERSONNES DE L'ORGANISATION où ce projet a été réalisé. |
| **How much do you agree or disagree with the following statements related to the organization's focus on their PEOPLE'S COMPETENCE REQUIREMENTS?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant l'accent mis par l'organisation sur les EXIGENCES EN COMPÉTENCES DES PERSONNES?** |
| 35. The organization manages the qualitative people's competence requirements for all the people involved in projects, programmes and portfolios (e.g. competence model, job descriptions for all project, programme and portfolio roles). | 35. L'organisation gère les exigences qualitatives en matière de compétences pour toutes les personnes impliquées dans les projets, les programmes et les portefeuilles (par exemple, modèle de compétences, descriptions de poste pour tous les rôles de projet, de programmes et de portefeuilles). |
| 36. The organization manages the quantitative people's competence requirements for all the people involves in projects, programmes and portfolios (e.g. HR and succession planning). | 36. L'organisation gère les exigences quantitatives en matière de compétences pour toutes les personnes impliquées dans les projets, les programmes et les portefeuilles (par exemple, la planification des ressources humaines et de la succession). |
| 37. The organization provides standards, regulation or guidelines for defining, planning and controlling people's competence requirements. | 37. L'organisation fournit des normes, des règlements ou des lignes directrices pour la définition, la planification et le contrôle des exigences en matière de compétences des personnes. |
| 38. The standards, regulations and guidelines are understood and applied by all project, programme, and portfolio staff and managers. | 38. Les normes, règlements et lignes directrices sont compris et appliqués par tout le personnel et les gestionnaires de projets, de programmes et de portefeuilles. |
| 39. All project, programme and portfolio managers and staff provide feedback and suggestions for the continuous improvement of people's competence requirements and the respective standard. | 39. Tous les gestionnaires et le personnel de projets, de programmes et de portefeuilles fournissent des commentaires et des suggestions en vue de l'amélioration continue des exigences en matière de |

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| | compétences des personnes et de la norme correspondante. |
| **How much do you agree or disagree with the following statements related to the organization's ability to <u>ANALYZE THE CURRENT STATE OF THEIR PEOPLE'S COMPETENCES</u>?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant la capacité de l'organisation à <u>ANALYSER L'ÉTAT ACTUEL DES COMPÉTENCES DE SES PERSONNES</u>?** |
| 40. The organization analyzes the current state of the project, programme and portfolio people's competences (e.g. competence assessments, benchmarking and gap analysis). | 40. L'organisation analyse l'état actuel des compétences des personnes dans les projets, programmes et portefeuilles (par exemple, évaluations des compétences, analyse comparative et analyse des écarts). |
| 41. The organization defines corrective action, if the requirements are not met (e.g. people's competences acquisition or development). | 41. L'organisation définit des actions correctives si les exigences ne sont pas satisfaites (par exemple, acquisition ou développement des compétences des personnes). |
| 42. The organization provides standards, regulations or guidelines for analyzing, identifying and evaluating the state of people's competences. | 42. L'organisation fournit des normes, des règlements ou des lignes directrices pour analyser, identifier et évaluer l'état des compétences des personnes. |
| 43. The standards, regulations and guidelines are understood and applied. | 43. Les normes, règlements et lignes directrices sont comprises et appliquées. |
| 44. All project, programme and portfolio managers and staff provide feedback concerning the state of people's competences and the respective standard. | 44. Tous les gestionnaires et le personnel de projets, de programmes et de portefeuilles fournissent des informations en retour sur l'état des compétences des personnes et sur la norme correspondante. |
| **How much do you agree or disagree with the following statements related to the organization's ability to <u>ACQUIRE/RECRUIT PEOPLE</u> with the required project, programme and portfolio competences?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant la capacité de l'organisation à <u>ACQUÉRIR/RECRUTER DES PERSONNES</u> ayant les compétences requises pour les projets, programmes et portefeuilles?** |
| 45. The organization provides standards for identifying, evaluating, selecting and assigning people (e.g. recruiting, assessment centre and job assignments). | 45. L'organisation fournit des normes pour l'identification, l'évaluation, la sélection et l'affectation des personnes (par exemple, recrutement, centre d'évaluation et affectations de postes). |
| 46. The organization uses available internal and external sources for the people's competences acquisition (e.g. job market, contractors and service providers). | 46. L'organisation utilise les sources internes et externes disponibles pour l'acquisition des compétences des personnes (par exemple, marché de l'emploi, sous-traitants et fournisseurs de services). |
| 47. The organization evaluates the suitability of people against a defined requirement before recruiting and assigning them tasks in project, programme and portfolio. | 47. L'organisation évalue l'aptitude des personnes par rapport aux exigences définies avant de les recruter et de leur attribuer des tâches dans le cadre d'un projet, d'un programme et d'un portefeuille. |

| | |
|---|---|
| 48. The standards, regulations and guidelines are understood and applied. | 48. Les normes, règlements et lignes directrices sont compris et appliqués. |
| 49. All project, programme, and portfolio managers and staff provide feedback concerning the people's competences acquisition and the respective standards. | 49. Tous les gestionnaires et le personnel de projets, de programmes et de portefeuilles fournissent des commentaires concernant l'acquisition des compétences des personnes et les normes respectives. |
| **How much do you agree or disagree with the following statements related to the organization's ability to invest in the DEVELOPMENT OF PEOPLE'S COMPETENCE to meet the requirements of projects, programmes and portfolios?** | **Dans quelle mesure êtes-vous d'accord ou pas d'accord avec les affirmations suivantes concernant la capacité de l'organisation à investir dans le DÉVELOPPEMENT DES COMPÉTENCES DES PERSONNES pour répondre aux exigences des projets, programmes et portefeuilles?** |
| 50. The organization provide standards for selecting, performing and evaluating the people's competences development (e.g. coaching, training and mentoring). | 50. L'organisation fournit des normes pour la sélection, la réalisation et l'évaluation du développement des compétences des personnes (par exemple, coaching, formation et mentorat). |
| 51. The organization uses the available internal and external providers for the people's competences development (e.g. on-the-job training, external training and certification). | 51. L'organisation fait appel à des prestataires internes et externes disponibles pour le développement des compétences des personnes (par exemple, formation en cours d'emploi, formation externe et certification). |
| 52. The organization evaluates the outcomes of people's competences development. | 52. L'organisation évalue les résultats du développement des compétences des personnes. |
| 53. The standards, regulations and guidelines are understood and applied. | 53. Les normes, règlements et lignes directives sont compris et appliqués. |
| 54. All project, programme and portfolio managers and staff provide feedback concerning the people's competences development and the respective standards. | 54. Tous les gestionnaires et le personnel de projet, de programme et de portefeuille fournissent des informations en retour sur le développement des compétences des personnes et les normes respectives. |
| **Thank you for taking the time to complete this survey! Your contribution is greatly appreciated.** | **Merci de prendre le temps de remplir ce sondage! Votre contribution est grandement appréciée.** |

## APPENDIX 4: UQO ETHICS CERTIFICATE

Le 24 février 2025

À l'attention de :
Catherine Cabot
Étudiante, Université du Québec en Outaouais

**Objet : Approbation éthique de votre projet de recherche**

**Projet #:** 2025-3440
**Titre du projet de recherche :** SHAPING PROJECT MANAGEMENT COMPETENCES: AN EXPLORATORY MULTILEVEL STUDY

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Votre projet de recherche a fait l'objet d'une évaluation en matière d'éthique de la recherche avec des êtres humains par le CER de l'UQO. Suivant l'examen de la documentation reçue, nous constatons que votre projet de recherche rencontre les normes éthiques établies par l'UQO.

Un certificat d'approbation éthique qui atteste de la conformité de votre projet de recherche à la *Politique d'éthique de la recherche avec des êtres humains* de l'UQO est par conséquent émis en date du 24 février 2025. Nous désirons vous rappeler que pour assurer la validité de votre certificat d'éthique pendant toute la durée de votre projet, vous avez la responsabilité de produire, chaque année, un rapport de suivi continu à l'aide du formulaire *F9 - Suivi continu*. Le prochain suivi devra être fait au plus tard le :

**24 février 2026.**

Un rappel automatique vous sera envoyé par courriel quelques semaines avant l'échéance de votre certificat.

Si des modifications sont apportées à votre projet, vous devrez remplir le formulaire *F8 - Modification de projet* et obtenir l'approbation du CER avant de mettre en œuvre ces modifications. Finalement, lorsque votre projet sera terminé, vous devrez remplir le formulaire *F10 - Rapport final.*

Notez qu'en vertu de la *Politique d'éthique de la recherche avec des êtres humains*, il est de la responsabilité des chercheurs d'assurer que leurs projets de recherche conservent une approbation éthique pour toute la durée des travaux de recherche et d'informer le CER de la fin de ceux-ci.

Nous vous souhaitons bon succès dans la réalisation de votre recherche.

**CERTIFICAT D'APPROBATION ÉTHIQUE**

La présente atteste que le projet de recherche décrit ci-dessous a fait l'objet d'une évaluation en matière d'éthique de la recherche avec des êtres humains et qu'il satisfait aux exigences de notre politique en cette matière.

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**Projet # :** 2025-3440

**Titre du projet de recherche :** SHAPING PROJECT MANAGEMENT COMPETENCES: AN EXPLORATORY MULTILEVEL STUDY

**Chercheure principale :**
Catherine Cabot
Étudiante, Université du Québec en Outaouais

**Directrice / codirecteur de recherche :**
Véronique Nabelsi; Christophe Bredillet
Professeur(e), Université du Québec en Outaouais

**Date d'approbation du projet :** 24 février 2025
**Date d'entrée en vigueur du certificat :** 24 février 2025
**Date d'échéance du certificat :** 24 février 2026

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Caroline Tardif
Attachée d'administration, CÉR
pour André Durivage, Président du CÉR

Signé le 2025-02-24 à 10:59

## APPENDIX 5: SSRRB CERTIFICATION OF ETHICS CLEARANCE


National Defence/Canadian Armed Forces
Social Science Research Review Board
101 Colonel By Drive'
Ottawa, Canada
K1A 0K2
SSRRB-CERSS@forces.gc.ca

**Certification of Ethics Clearance**

The Department of National Defence/Canadian Armed Forces Social Science Research Review Board (SSRRB) has granted ethics clearance for the research project described below. The SSRRB is constituted under the Defence Administrative Orders and Directives (DAOD) 5061 and 5062 and operates in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2).

| | |
|---|---|
| **SSRRB Number:** | **2225/25N** |
| **Project Title:** | **Shaping Project Management Competence: An Exploratory Multilevel Study** |
| **Principal Investigator:** | **Maj Catherine Cabot** |
| **Investigator's Institution (If applicable)** | **Université du Québec en Outaouais** |
| **Effective:** | **4 April 2025** |
| **Expires:** | **4 October 2026** |

Research may now proceed with the following conditions.

- Clearance is granted only for the research and purposes described in the final, approved application.
- Any modification to the approved research must be submitted to the SSRRB via email. All changes must be cleared prior to the continuance of the research.
- During the study, if you encounter an adverse event, material incidental finding, protocol deviation or other unanticipated problem, you must notify the SSRRB by email as soon as possible.
- For student research, it is the responsibility of the student to notify their supervisor of any adverse events, changes to their application, or requests to renew/close the protocol.
- This approval is valid for the period of 18 months from the date of this letter. Participant involvement must be complete by this date; otherwise, the protocol will require further review. It is the Principal Investigator's responsibility to contact the SSRRB if an extension is required.
- The Principal Investigator shall provide the DND/CAF Sponsor with a copy of the final report or project deliverable.
- The SSRRB maintains the right to communicate directly with personnel or organizations involved with or supporting this research project, such as other research ethics boards, universities and colleges, students' academic advisors, and Government of Canada organizations.
- Failure to conduct the research in accordance with the direction provided in DAOD 5061 and 5062, the principles of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans



Form updated: 1 May 2023

2nd edition, and the SSRRB Standard Operating Procedures (SOPs) may result in the suspension or termination of the research project.

Please be aware that SSRRB submission documents, emails to and from the SSRRB, and other electronic information or documents related to this research project constitute Government of Canada records and, as such, are subject to the Access to Information Act, the Privacy Act and Government and DND/CAF regulations, policies and procedures. Canadian citizens, permanent residents of Canada, and individuals or corporations currently present in Canada may obtain copies of information held in Government files. Prior to releasing any information, the Director Access to Information and Privacy screens the information to ensure that the identities of individuals are not disclosed.

Please email the SSRRB Coordinators at SSRRB-CERSS@forces.gc.ca if you have any questions.

X MCCUAIG EDGE, HEATHER 521

Digitally signed by MCCUAIG EDGE, HEATHER 521
Date: 2025.04.04 14:37:14 -04'00'

Heather McCuaig Edge
SSRRB Coordinator

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