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A DUAL-APPROACH TO PROJECT TEAM OPTIMISATION: BALANCING THE 'SHACKLETON' AND 'WEAKEST-LINK' EFFECTS

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This study discusses executive cross-department project team performance in relation to team competency structures. Detailed market-oriented (MO) competencies of team members and performance data are investigated. The empirical analysis based on relationship marketing theory and applied psychology theories shows that for the achievement of budget and deadline goals, it is primarily static competencies that matter; whereas, for the achievement of quality goals, also dynamic competencies matter. Moreover, the role of the strength distribution of competencies is stressed by arguing that team members with strong MO competencies matter for budget and deadline goals (Shackleton principle), while the weakest member has a critical impact on quality goals (weakest-link-of-the-chain principle).

Keywords: group decisions, team performance, Shackleton principle, weakest-link-of-the-chain principle

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INTRODUCTION

Teams are responsible for a host of productive activities. The study of teams and their performance has accordingly been at the centre of research in various scientific disciplines. Research has grown from the IPO model depicting team inputs, processes, and outcomes, which dominated the research on teams for years, to building alternative theoretical explanations of the mixed empirical results (i.e., Jugdev & Müller, 2005). In this paper, we deal with the diversity of team members' competencies and how it impacts a team's performance. Here, the role of studies in applied psychology should be highlighted because this discipline has thus far paid the greatest attention to the topic (e.g., Mathieu et al., 2017).

Several researchers from the mentioned discipline have suggested that the key feature underlying the differences among team members refers to social category diversity and informational/functional diversity. The former examines team diversity and its impact on performance from the perspective of forming subgroups (categorisation processes) and a negative impact on team performance. The latter stresses a broader range of task-relevant knowledge, a larger pool of resources, and the positive effects of diversity of team competencies on team performance. Many studies consider these two contrasting phenomena (for meta-analyses, see Bell et al., 2011; van Dijk, 2022). In contrast, in our study we follow van Knippenberg et al.'s (2004) contention that each dimension of team diversity can function as both social category diversity and information/functional diversity. Although a team possessing a diversity of competencies is a fact of life in the business world, business teams are rarely studied from the above perspectives – a consequence of a lack of data. This paper relies on methodologically rigorously collected data regarding the performance of 1,400 cross-departmental executive project teams in the Slovenian construction company Trimo Trebnje for the period 2006–2012, detailing team members' market-oriented (MO) competencies and team performance over a period of 6 years.[1] It thus fills a gap with respect to the diversity of a team's competencies and their verification in corporate practice.

Using complex statistical and econometric techniques, team competencies are evaluated and linked to team results, examining which and how the MO (market-oriented) competencies in cross-departmental executive project teams are important for achieving various types of team goals.

The paper makes several important theoretical, but particularly empirical and practical contributions to the field, primarily extending the debate on complementarity between competencies and the importance of the structure of teams for firm performance. This debate can also be extended to the chal-

lenges of efficient organisation in both self-managing teams in profit-seeking organisations and teams in not-for-profit organisations, as well as the broader issues of ownership, politics and policymaking, including national development. Important practical contributions are provided, especially for HR managers, concerning human resource development and training.

LITERATURE REVIEW AND HYPOTHESES

Market-oriented competencies and team performance of cross-departmental executive project teams

Greater collaboration with customers in many business organisations (e.g., in the construction industry) calls for a high level of coordination, participation in joint programmes, and close communication links. For this reason, multifunctional and cross-departmental executive project teams are formed (Day, 1994; Lo & Kam, 2021). While the task positions and competencies held by the members of such teams are diverse (i.e., commercial manager, digital manager, project manager, assembly manager, design manager, product manager etc.), close communication and joint problem-solving affirm team-based mechanisms for the continuous exchange of information about their needs, problems, and emerging requirements, which is followed by the taking of action (e.g., Hu & Randel, 2014).

Further, a market orientation (MO) requires that cross-departmental executive project teams have and develop knowledge *(know-)* with a focus on the *how, what, why, where* and *when* or, in other words, building and strengthening their MO know-X (Garud, 1997; Madhavaram et al., 2014): (1) MO know-how involves knowledge concerning how to perform a task. It is related to knowledge about the market and the integration of this knowledge into production processes; (2) MO know-what includes knowledge about which tasks to perform. It is closely linked to knowledge of market participants (customers, competitors, suppliers) and the market environment (the social, cultural, legal and macroeconomic environments); (3) MO know-why chiefly answers questions about the need to do certain things and the principles of the processes being executed; (4) MO know-where focuses on obtaining information with respect to future markets and customer preferences; and (5) MO know-when focuses on the timing of adapting new knowledge and refers to the knowledge of adapting new technologies and new products. As regards measures of project success, definitions of project success include indicators like deadline, budget and scope (quality) (Atkinson, 1999; Lo & Kam, 2021). Still, Baccarini (1999) distinguishes two compo-

nents of project success: 1) project management success, which concentrates on the project's process(es') (efficiency); and 2) product success, which deals with the effects of the project's final products (effectiveness). Quality may be seen as an effectiveness measure since it reflects all the aspects needed: customer satisfaction, product success and innovation, and project management success, while budget and deadline are regarded as efficiency measures as they are related to project management success (Icmeli Tukel & Rom, 2001).

Linking the above to the MO know-X (where X here refers to how, what, why, where, and when) competencies held by executive cross-departmental executive project team members, the first hypothesis in our research states:

H1: The better the MO know-X competencies of the project team, the better its performance in terms of achieving the project's objectives, budget, deadline and quality.

Team member diversity perspectives

In the applied psychology literature, different views can be found on the diversity of team members and its impact on a team's performance. The most important are the informational/functional perspective and the social categorisation perspective. They represent opposite poles of the spectrum since the former predicts a positive impact of diversity on performance while the latter predicts a negative one. The information/decision approach claims that diversity is an information resource that leads to higher quality decision-making and better performance (Homan et al., 2007), whereas the social categorisation perspective assumes that people divide others into those who are like them (i.e., members of their own group) and those who are not (i.e., members of the other group). Categorisation processes can produce subgroups within the work group and cause problematic relationships between subgroups, resulting in the team's lower performance (van Knippenberg et al., 2004).

To some extent, both theories can be applied to the MO competencies possessed by multifunctional and cross-departmental executive project teams. The information/decision-making approach holds a preference for a variety of task and competencies information because of differences in knowledge and better information resources (Williams Phillips & O'Reilly, 1998). To achieve the quantitative goals (budget, deadline) that are essential for teams to be included in the corporate portfolio (higher profit), the planning and monitoring of the quantitative project goals is a primary activity, and the MO operational (standard) competencies held by team members are important (team efficiency).

In contrast, the provision of adequate product quality is a source of sustainable performance in the marketplace (team effectiveness), and operational (standard, static) and dynamic (non-standard) competencies are also important. Related to this, the social categorisation perspective states that in simple tasks performed by teams where only a limited number of strategies are available (i.e., routine tasks), accuracy, i.e., the degree to which members' mental models adequately represent a given body of knowledge (operational competencies), is more important for team performance than similarity, which describes the extent to which members' models are similar or overlap. In addition, it is more likely that team members will rely on stereotypes to anticipate how others will behave (Fiske et al., 2002). They might attribute a higher level of competence to a team member who is dissimilar from themselves if that person's attributes are stereotypically more aligned with those needed for the task (Eagly & Karau, 2002). Reducing uncertainty by relying on such competence stereotypes can be very helpful for members of diverse teams if the degree of uncertainty is not so high (van Dijk, 2022). Nevertheless, similarity is more important in complex and more uncertain environments with multiple possibly correct paths or effective strategies and more developed dynamic competencies among team members (LePine, 2005; Mathieu et al., 2017). Besides, if the level of uncertainty is high, all team members should be involved to reduce the uncertainty by gathering and evaluating information (Griffin & Grote, 2020).

Both theories are thus acceptable while considering the same processes as a composition of different phases. This leads to the position adopted by van Knippenberg et al. (2004) that it is necessary to consider processes in which all dimensions of diversity can give rise to the elaboration of task-relevant information as well as social categorisation processes. The integration of both theories is proposed by the same authors in the Categorisation-Elaboration Model (CEM), which shows how diversity in a team affects team performance through information/decision-making processes (i.e., elaboration processes) and social categorisation processes. The first phase of process analysis is to gather information about all tasks (competencies) and evaluate them. Gathering and evaluating information is critical for identifying the potential positive outcomes of diversity. This is followed by the contingencies of the social categorisation and similarity attraction processes that underlie the negative effect of diversity, the grouping of team members, whether it be by skin colour, religion, geographical origin, technical vs non-technical occupations, according to different profiles of technical people or any other criteria. The more complex the tasks, the more important the social cate-

gorisation perspective. Conversely, the core task of team leaders is to develop an accurate attitude to diversity (diversity mindsets) and to involve all members in finding solutions (van Knippenberg & van Ginkel, 2022). Namely, to achieve simple (standard) goals that rely on the operational competencies of team members, strong leadership and information gathering and assessment are vital. To achieve complex goals, operational and dynamic competencies are important, and defining an accurate diversity mindset, sharing among team members, and team reflexivity are crucial for avoiding negative consequences of team diversity (van Knippenberg et al., 2013).

Linking the above discussion to the MO know-X competencies possessed by cross-departmental executive project team members, the MO know-how, MO know-what and MO know--why competencies of the team members could be clearly defined as operational competencies determined by the project's proposed budget and deadline goals. They are expected to have a positive relationship (i.e., impact) on the budget and schedule objectives, provided by the most competent people in the team (included in the required planning and execution steps). Alongside the MO know-how, MO know-what and MO know-why competencies of team members, the achievement of quality-related goals depends on MO know-where and MO know-when, i.e., the dynamic competencies held by all team members because this knowledge is critical for adaptability in an unknown or only roughly known environment at the time the contract is signed. Quality-related goals accordingly require that team members possess: (1) sufficiently developed operational competencies for the consistent implementation of processes in line with defined customer needs (contracted product); and (2) sufficiently developed specific (dynamic) competencies (e.g., knowledge concerning how the quality offered might be perceived by their customers in a changing market environment, i.e., knowledge that is important for possible future changes in the market and adapting to technological novelties and shifts in preferences as well as other uncertainties with implementation). Based on the above, two more hypotheses are proposed.

H2: Achieving budget and deadline goals primarily depends on operational MO competencies, and team members who hold stronger competencies are 'more important' than members with weaker MO competencies (the 'Shackleton' principle).

H3: Project quality goals depend on all MO competencies (including dynamic competencies) and team members with weaker MO competencies determine the quality the project can achieve (the 'weakest-link' principle).

DATA AND ESTIMATION METHOD

The data

The Trimo company dataset comprises details concerning cross--departmental executive project teams and project outcomes for 1,400 construction projects completed between 2006 and 2012.

Our data include task descriptions for each member of the team, and an evaluation of their MO competencies. Competencies were evaluated using five market-oriented competence groups of indicators (MO groups of indicators) measuring customer focus (CF), team organisational agility (TOA), personal excellence (PE), innovations (INN), and permanent growth and development (PGD) (Table 1). Each competence group in the company contains several indicators (individual competencies), evaluated on a scale from 1 to 5. The actual competence assessment was based on a 270-degree assessment (self-assessment + colleagues + superior) or a 180-degree assessment (self-assessment + superior).

TABLE 1
The Trimo-Amitas original competence model

Customer focus (CF)	Organisational agility (OA)	Personal excellence (PE)	Innovations (INN)	Permanent growth and development (PGD)
Customer focus	Change management	Developing people's potential	Ideation	Vision
Networking	Project management	Self-development	Innovation management	Global perspective
Building relationships	Team building	Performance management	Creativity	Openness to new approaches
Empathy	Organisational skills	Individualisation	Curiosity	Strategic leadership
Negotiation skills	Adaptability	Learning	Conceptual thinking	Personal agility
Communication	Action-oriented	Motivating people	Solving problems	Achieving results
Professional attitude	Decision-making	Responsibility	Passion for technology	Planning
		Mentoring		Coaching

Source: Trimo/Amitas (2016).

In a study of customer focus competencies and team performance (Bole et al., 2016), the authors investigated the role played by customer focus (CF) competencies in the success of cross-departmental executive project teams in Trimo. Nonetheless, new insights from business research reveal the importance of other market-oriented competencies of executive

project team members for the success of their teams. Personal excellence, Permanent growth and development of each team member, Change adaptation and Passion for technology (digital technologies) belong to this set of competencies. Since the database of the Trimo company encompasses such data, in this paper the entire psychometric instrument (competency model) is tested using the Trimo dataset.

TABLE 2
Trimo-Amitas MO competence model in line with the MO know-X framework

Type of knowledge	MO knowledge	Often a result of learning by…	The Trimo and Amitas MO project team competencies set	Type of competencies
MO know-how: How to perform a task consistently?	Market knowledge and customer response competence	Doing	Customer focus (CF)	Operational competencies
MO know-what: Which tasks to perform?	Knowledge of customers, suppliers and competitors, and knowledge of market environments	Using	Customer focus (CF)	
MO know-why: Why care about the team's goals?	Knowledge of organisational culture	Studying	Organisational agility (OA)	
MO know-where: Where to look to supplement the existing knowledge base?	Knowledge of future markets and customer preferences	Networking	Personal excellence (PE) Innovations (INN) Permanent growth and development (PGD)	Dynamic competencies
MO know-when: When to adapt new knowledge?	Knowledge of the adaptation of new technologies and new products	Forgetting	Personal excellence (PE) Innovations (INN) Permanent growth and development (PGD)	

Sources: Adapted from Garud (1997), Madhavaram et al. (2014) and Trimo/Amitas (2016).

Table 2 provides details of the adaptation of the Trimo-Amitas competence model to the MO know-X framework. In the context of the Trimo strategy, MO know-how is largely incorporated in the customer focus (CF) group of competencies. Knowledge of competitors and suppliers and knowledge of the market environment was less important in the Trimo/Amitas (2006) model for cross-departmental executive project teams since these areas were being handled by other departments and teams in the company (e.g., the marketing and purchasing departments). However, the knowledge of customers was crucial for cross-departmental executive project team members

at Trimo. MO know-what is also incorporated in the customer focus (CF) group of competencies. MO know-why is included in the organisational agility (OA) group of competencies, which mainly concerns team organisation. The personal excellence (PE) competence group, the innovations (INN) competence group, and the permanent growth and development (PGD) competence group are more strongly related to MO know-when and MO know-where.

Achievement of the budget and deadline goals principally relies on the operational competencies closely linked with the ability to execute project-related tasks efficiently, assuming no unexpected changes occur in the production process. The customer focus (CF) and organisational agility (OA) groups can hence be the best representatives of operational competencies. They include customer focus, building relationships, negotiation skills, communication, professional attitude, team building, organisational skills, project management, and decision-making (see Table 1), which all directly contribute to the efficiency of execution. On the other hand, the (dynamic) quality goal is also closely related to the development potential of the team's members; i.e., competencies like developing people's potential, learning, self-development, ideation, creativity, passion for technology, vision, strategic leadership, and others that are crucial for adjusting to unexpected changes (see Table 1). These competencies, which were captured within the personal excellence (PE), innovations (INN) and permanent growth and development (PGD) groups of competencies (in the Trimo-Amitas classification), may thus be seen as dynamic competencies that assure higher quality, including the knowledge concerning the use of new materials and technology, and new markets, in turn allowing the production function to move outwards.

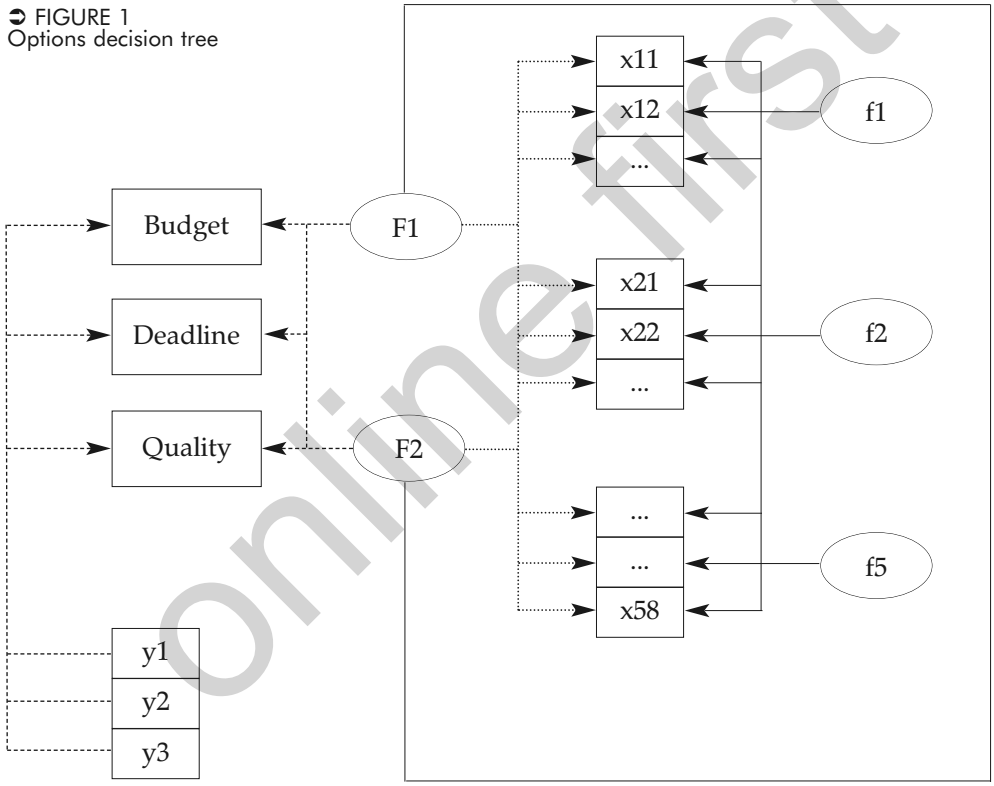
Estimation procedure

To explain the fulfilment of project goals in terms of large numbers of multicollinear competencies (and potential other variables), the estimating procedure entailed several steps. In Figure 1, the options decision tree (potentially important variables and relationships) is sketched in a hypothetical SEM scheme to reveal the logic of the modelling procedure.

Due to the considerable number of relevant variables and high multicollinearity among the 37 MO know-X variables, the number of variables was reduced using exploratory factor analysis. The high KMO and the size of the eigenvalues (Kaiser criteria) show that one latent variable is common to the indicators of *each group* of MO know-X indicators. Each group of competencies is therefore efficiently summarised by one factor (Table 3).

High collinearity is additionally observed among the constructed latent variables. Consequently, all indicators (37 competencies) were simultaneously embraced also by two latent factors generated from those indicators. Competence variables x_{ij} (i denoting group and j competence) are embraced by factors F1 and F2. In Figure 1, the corresponding relationships are dotted. The factors are orthogonal and, given the absence of the multicollinearity problem (see Table 3), could be directly used for specifying the model of competencies' effects on the team performance (for budgeting, timing and quality) together with two other (non-competencies) types of variables y_k (the size and business environment variables). In Figure 1, the corresponding relationships are dashed.

➲ FIGURE 1
Options decision tree



If factors F1 and F2 were to have a theoretical meaning (which could be checked/achieved by orthogonal rotations), we would be able to simply continue with the existing factors F1 and F2 as explanatory variables.[2] However, neither factor F1 nor F2 has a clear theoretical meaning even after several rotation procedures. This made it impossible to construct testable relations (regarding competencies) for such a specification of team performance models.

Groups of competencies	No. of competencies	No. of factors	KMO	Cronbach alpha	Names and abbreviations of factors
Customer focus (CF)	7	1	0.875	0.887	Factor (CF), f_1
Organisational agility (OA)	7	1	0.848	0.875	Factor (OA), f_2
Personal excellence (PE)	8	1	0.928	0.947	Factor (PE), f_3
Innovativeness (INN)	7	1	0.879	0.886	Factor (INN), f_4
Permanent growth and development (PGD)	8	1	0.887	0.928	Factor (PGD), f_5
Overall (total) evaluation	37	2	0.918	0.963	Factor 1, F_1 Factor 2, F_2

TABLE 3
Groups of competencies, number of factors, KMO sampling adequacy, and Cronbach's alpha

The fact that we were unable to find a rotation of F1 and F2 enabling a meaningful interpretation, the disentangling of the estimated competencies' impacts (in impacts of analysed groups of competencies CF, OA, PE, INN and PGD) led us to make such a separation in two steps. In step one, we find, heuristically speaking, 'aggregated' effects of factors F1 and F2 on the corresponding goal variable, while in step two these estimated 'aggregated' effects of factors F1 and F2 are disentangled on the contributions of factors f1, f2, ...f5 of the analysed groups of competencies CF, OA, PE, INN and PGD. This two-step procedure is based on the following trivial corollary of the factor model representation of the competencies.

If the vector of competencies is denoted by $X = (X_1^t, X_2^t, \ldots X_5^t)^t$ (X = 37x1), where X_i are vector columns of subsets of competencies (i.e., CF, OA, PE, INN and PGD), then the basic relations of the factor model are as follows (see, e.g., Rao, 2001).

$$X = AF + U \; var(F) = I \; cov(F,U) = 0 \; and \; var(U) = \\ = diag(\omega_j) \; and \; var(X) = \Delta = AA^t + diag(\omega_j) \qquad (1)$$

where A (37x2) is a matrix of factor loadings, U (37x1) is a vector of individual effects and $F = (F_1, F_2)^t$ is the vector of latent variables (factors). If the latent variables of the theoretical competencies' impact on the quantitative and qualitative goals is denoted by $\alpha^t F = (\alpha_1^t F, \alpha_2^t F, \alpha_3^t F)^t$ (where α_i^t for goal i, i = 1, 2, 3 is vector 1 x 2), then the conditional expectation of $\alpha^t F$ given any vector of linear combinations of competencies ΦX (Φ is n *x 37*) is given by

$$E(\alpha^t F X^t \Phi^t)(\Phi \Delta \Phi^t)^{-1} \Phi X = (\alpha^t A^t \Phi^t)(\Phi \Delta \Phi^t)^{-1} \Phi X \qquad (2)$$

In a special case, when Φ is a matrix of coefficients for one linear combination for each subset (CF, OA, PE, INN and PGD) of competencies (i.e., $\Phi = (\Phi_1^t, \Phi_2^t, \ldots \Phi_5^t)^t$ where vector row Φ_j, j = 1, ... 5 corresponds to subset j of competencies), equation

(2) enables the disentangling and comparison of the impacts of different subsets of competencies for each specific goal function. Namely, the impact of competencies from subset j j = 1, ... 5 on goal function i (i = 1, 2, 3) is equal to

$$(\alpha^t_i A^t \Phi^t) (\Phi \Delta \Phi^t)^{-1} \Phi_j \quad (3)$$

where Φ_j denotes the j-th segment of columns of matrix Φ corresponding to subset j of competencies and α^t_i denotes the impact of factors F on goal i.

The theoretical impact (3) may be evaluated using the delta method or artificial (formal) regression in which the competencies' impacts estimated in the basic model (step one) are regressed on factors f_1, f_2, f_3, f_4, f_5 extracted from each of the competencies' subsets (CF, OA, PE, INN and PGD). We used the second alternative. The results are presented in Table 6.

RESULTS

Table 4 presents summary statistics for the model's key variables in three separate columns: first, for the entire period 2006–2012, and then separately for the pre-financial crisis period 2006–2008 and the Great financial crisis period 2009–2012. Projects were classified into sub-periods by year of completion. While before the financial crisis (2006–2008) the company had 293 projects (and project teams) on average per year, during the crisis the annual number fell significantly to just 129 projects. The median project team consisted of five or six team members.

Table 4 also presents data on the key performance indicators. To assess performance, the difference between planned and actual performance was compared using the following transformations:

$$\text{deadline goal} = \frac{\text{actual duration} - \text{planned duration}}{\text{actual duration}}$$

$$\text{budget goal} = \frac{\text{actual budget} - \text{planned budget}}{\text{actual budget}}$$

$$\text{quality goal} = \frac{\text{no. of quality projects}}{\text{all projects,}},$$

$$\text{where quality} = \begin{cases} 0, \text{ when no additional costs were caused due to a droping quality,} \\ 1, \text{ otherwise)} \end{cases}$$

On average, the actual duration of a project was shorter than its planned duration, indicating efficiency in terms of duration. Still, on average, the actual budget exceeded the planned budget. As regards the quality-related goals, close to 75% of the projects were within budget, indicating that the (feasible) quality goal was achieved. Beyond-budget costs usually arose be-

cause of the low quality of materials used. The median values of the actual and planned budget grew from the pre-crisis to the crisis period, the median planned project duration became shorter, whereas the actual duration became longer. The share of projects reaching the contracted level of quality was larger in the pre-crisis period.

		Whole sample	Pre-crisis (2006–2008)	Crisis (2009–2012)
Key goal data	Number of projects	1,400	884	516
	Actual duration (days): mean value; Median and Standard deviation in brackets	157 (100, 167.5)	151 (99, 147.8)	167 (102, 196.5)
	Planned duration (days): mean value; Median and Standard deviation in brackets	211 (121, 265.9)	218 (135, 234.0)	198 (101, 312.8)
	Actual budget (in €): mean value; Median and Standard deviation in brackets	39,868 (11,453, 111,638)	34,228 (9,137, 88,194)	49,532 (15,159, 142,728)
	Planned budget (in €): mean value; Median and Standard deviation in brackets	38,240 (11,453, 107,747)	32,186 (8,327, 86,229)	48,612 (14,085, 136,447)
	Share of high-quality projects	0.732	0.758	0.687
Size	Number of team members: mean value; Median and Standard deviation in brackets	5.35 (5, 0.727)	5.23 (5, 0.685)	5.56 (6, 0.745)
Competencies' assessment	Actual MO competencies' assessment – factor CF: median; Standard deviation in brackets	2.87 (0.205)	2.87 (0.206)	2.89 (0.202)
	Actual MO competencies' assessment – factor OA: median; Standard deviation in brackets	2.83 (0.153)	2.86 (0.150)	2.78 (0.157)
	Actual MO competencies' assessment – factor PE: median; Standard deviation in brackets	2.43 (0.138)	2.43 (0.136)	2.44 (0.141)
	Actual MO competencies' assessment – factor INN: median; Standard deviation in brackets	2.63 (0.147)	2.62 (0.149)	2.64 (0.143)
	Actual MO competencies' assessment – factor PGD: median; Standard deviation in brackets	2.63 (0.110)	2.63 (0.109)	2.62 (0.161)
	Actual MO competencies' assessment – factor 1: median; Standard deviation in brackets	2.53 (0.147)	2.53 (0.143)	2.55 (0.154)
	Actual MO competencies' assessment – factor 2: median; Standard deviation in brackets	2.87 (0.228)	2.87 (0.233)	2.89 (0.218)

TABLE 4
Summary statistics for the variables used for estimating team performance measures based on project goals (budget, deadline, quality)

The median team assessments of the CF and INN competencies (their corresponding factor values, ranging from 1 to 5) increased, the median team OA competencies' assessments decreased, while the median PE and PGD competencies' assessments remained on the same level during the two periods under observation. Two latent orthogonal variables were generated to capture the information from all the specific competencies (bottom two factors, Table 4). In both cases, the median team assessments of MO competencies increased from the pre-crisis to the crisis period.

Table 5 (first step results) reveals the impact of the variables of interest on the project teams' performance in terms of budget and deadline goals and the quality-related goal. While modelling the impact of the independent variables on the project's budget and deadline goals, OLS regression was applied. To model the impact of the variables of interest on the achievement of the quality-related goal, logistic regression was applied due to the nature of the dependent variable (0 and 1). For each model, MO competencies' assessments were captured by two orthogonal latent variables (namely, F1 and F2) acquired from the factor analysis of all MO indicators.

TABLE 5
Models of performance measure estimations

	Quantitative goals		Quality-related goal
	Model A: budget performance (current budget – planned budget) / current budget	Model B: deadline performance (current deadline – planned deadline) / current deadline	Model C: quality performance 0 = high quality 1 = low quality
	third quartile (75th per.) competencies	third quartile (75th per.) competencies	first quartile (25th per.) competencies
MO competencies' overall assessment – factor value 1	-1.401 (1.186)	-4.712 (6.265)	-2.542** (1.023)
MO competencies' overall assessment – factor value 2	-3.971** (1.756)	-12.865* (6.689)	-1.503** (0.752)
Standard deviation of competencies' assessment	2.149 (2.365)	19.431* (11.079)	-0.83 (0.588)
Crisis (2009–2012)	-0.033 (0.046)	1.123*** (0.184)	0.003 (0.115)
Number of team members	-4.337 (2.932)	56.972*** (13.008)	0.669 (0.709)
Planned deadline			0.555*** (0.084)
Planned budget			0.513*** (0.059)
Constant	25.374*** (8.705)	-93.841** (6.565)	0.985 (0.383)

Note: Model A and model B are estimated by linear regression and model C by logit regression (Huber-White sandwich estimator); in the model for budget and deadline performance, the third quartile of competence factor values is used, while the first quartile of competence factor values is used in the model for quality performance; the number of team members, planned budget, and planned duration are in logs; crisis activity is a fraction of project activity after 2008; standard errors are in parentheses; ***, ** and * represent statistical significance at 1%, 5% and 10%, respectively.

The results (Table 5) confirm that the stronger the MO competencies, the better the team performance in terms of the project's budget goal, deadline goal, and quality-related goal. The estimated coefficients of the MO competencies (embraced by F1 and F2) are, namely, negative and statistically significant when the quality model (C) is addressed, while those for achieving the budget goal (model A) and deadline goals (model B) are also negative, albeit significant only for the second factor.

These estimates also confirm that the distribution characteristics of crucial team competencies vary among project goals. For instance, they show that for each performance measure a specific quartile of the team's competence distribution is critical. For each project goal, we estimated five alternative models for five different characteristics of the distribution of the team's competence assessments (min, p 25, p 50, p 75, max). For the budget and deadline goals, the third quartile gives the best result. Achieving these two project goals accordingly depends to a stronger extent on the more competent team members in terms of MO competencies' assessments. On the other hand, the first-quartile versions of the models are appropriate for the quality-related goal since the regression coefficient is negative and statistically significant only in the model with first-quartile MO competencies' assessments.[3]

Model results show that lower dispersion (standard deviation) of the team competencies adds to the likelihood of achieving both quantitative goals as well as the quality-related goal, although the effect is significant only for the deadline goal. Obviously, the effects of the distribution of team members' competencies on project goals should be specified using not only the parameters of the central tendency but also those of the quartiles of the team competencies' distribution.

The model for the quality-related goal (model C, Table 5) also incorporates the planned project duration and the planned budget as two important variables. In a customer-oriented environment, the client would evaluate the 'quality of the customised product', which includes steps from design to maintenance, as being dependent on duration as well as any deviation from the budget. Both have a 'survival'-type specification in the (logit) quality model equation, implying that the probability of quality deteriorating in any project phase is independent of the other project phases. The cumulative probability of a quality drop in any project phase depends on the logs of the project size (duration, budget) variables.

To control for other relevant impacts, two further variables were included: team size and financial crisis impact. The results imply that: (1) the size of the team increased the difference between actual (current) and planned project deadline. The coefficient of team size (the number of team members) in the equation of the model for the deadline goal (model B) is, namely, positive and significant. In the main model (third quartile of competence assessment) for the budget goal (model A), the team size coefficient is negative and not significant. Size coefficient in the quality model (model C) is also not significant, albeit positive, indicating that larger teams could lead to lower quality. Concerning the Great financial crisis,

the results show that it significantly increased the difference between actual (current) and planned deadline goal (model B), whereas the impact was non-significant for the other goals. Even though the Great financial crisis did not impact the budget and the quality goals, it did impact the deadline goals, potentially due to the higher number of employees in teams.

The lack of appropriate data meant we were unable to check data on competencies for potential biasedness since the evaluation process also includes self-assessment. Still, it is necessary to note that given that only quantile variables of competencies (with a fixed five-point scale) are used in the model, potential biasedness caused by self-assessment would only change the constant in the model and not the factor variables' effects under study.

TABLE 6
Models of project goal measures estimations

	Quantitative goals		Quality-related goal
	Model A: budget performance	Model B: deadline performance	Model C: quality performance
	third quartile (75th per.) competencies	third quartile (75th per.) competencies	first quartile (25th per.) competencies
	Conditional measure of MO competencies as a dependent variable	Conditional measure of MO competencies as a dependent variable	Conditional measure of MO competencies as a dependent variable
CF assessment	2.116*** (0.174)	6.894*** (0.565)	0.527*** (0.072)
OA assessment	2.410*** (0.212)	7.875*** (0.689)	0.966*** (0.053)
PE assessment	-0.097 (0.157)	-0.271 (0.514)	0.762*** (0.109)
INN assessment	0.085 (0.140)	0.309 (0.457)	0.422** (0.185)
PGD assessment	-0.098 (0.167)	-0.283 (0.547)	0.511*** (0.099)
Constant	2.818*** (0.391)	8.966*** (-1.271)	-1.882*** (0.544)
Imputation	20	20	20
Observation	1399	1393	1399
Average relative variance increase (RVI)	10.368	10.558	13.304
Model F-test (p)	184.43 (0.0000)	187.88 (0.000)	176.29 (0.000)

Note: Models are estimated by linear regression; the dependent variable is conditional competence (a linear combination of factors F1 and F2 using coefficients from Table 5); CF represents the factor summarising the customer focus group of competencies, OA the organisational agility factor, PE the personal excellence factor, INN the innovations factor, and PGD the permanent growth and development group of competencies factor; standard errors are in parentheses; ***, ** and * represent statistical significance at 1%, 5% and 10%, respectively.

The models presented in Table 6 (second step results) disentangle the estimated conditional project goal effect of all competencies (embraced by both factors F1 and F2) on the effects of operational and dynamic competencies. This conditional effect is quantified by a linear combination of factors F1 and F2 in which goal-specific coefficients from Table 5 are used. For the conditional competence effect estimated for the budget goal (model A) and the deadline goal (model B), the CF and the OA competence group factors are positive and statistically significant, whereas the regression coefficients for the PE, INN and PGD competence group factors are not statistically significant. This reveals that operational competencies matter for the achievement of quantitative goals. In the case of the common competence effect on the quality goal, the regression coefficients of each of the five competence group factors are positive and statistically significant. Both operational and dynamic competencies are thus shown to contribute to the accomplishment of the quality-related goal.

DISCUSSION AND CONCLUSION

Contributions

The paper makes several contributions to scientific literature. By finding that better MO competencies lead to better project team performance, the study sheds light on relationship marketing and networking. By showing that in a less complex environment operational competencies chiefly contribute to the achievement of simpler goals (budget, deadline), while operational and dynamic competencies are important for the achievement of more complex goals (quality), the study confirms the theoretical discussion on the need to include both prevailing theories of team members' diversity (see, van Knippenberg et al., 2004) while explaining the performance of teams. Furthermore, the study highlights the role of the distribution of competency strengths by showing that team members who possess stronger MO competencies influence the budget and deadline goals, while the weakest member has a decisive influence on achievable quality-related goals.

How can these findings be explained while considering functioning teams in a business environment? Diversified teams in a business need to work in a focused way. For example, the company's business results depend on the success of cross-departmental executive project teams in the construction industry. Strong leadership concerns the implementation of quantitative goals (budget, deadline). No company will be happy with a team leader if the cross-departmental executive team

mostly shows higher actual (current) goals than the planned goals. Although the participation of all members of the cross-departmental executive team is required, the constant review of the actual and planned quantities and alignment with the corporate goals (profit) lies in the hands of employees with demonstrated MO competencies. This application is labelled in our work as the 'Shackleton principle', after Ernest Shackleton who set out to cross the Antarctica along with 27 men, but because of the severe cold saw their ship stuck in the ice for 10 months. Firm leadership was essential for achieving the team's project goals. It is therefore not surprising that, according to our estimates, teams with better operational MO competencies achieved better results.

Still, the effectiveness of Shackleton team leadership involves another component: the flexibility of the leader. The 'open door policy', long before that term was coined, allowed Shackleton's team to survive in the difficult conditions. Inclusive leadership (to give all team members a sense of belonging and uniqueness) and leadership in diversity mindsets (managing information processing for routine and non-routine tasks, synergistic outcomes) in terms of modern team leadership theories (see, e.g., van Knippenberg & van Ginkel, 2022) best circumscribe Shackleton's crucial intentions. In the context of corporate teams, more specifically cross-departmental executive projects teams in the construction industry, the achievement of a quality-related goal (the highest quality) is a basic requirement for the survival of a company in the market (see, e.g., Baccarini, 1999). The involvement of all team members (the principle of the 'weakest-link-in-the-chain') and the elaboration of team results by the whole team is an important mediator for achieving long-term team effectiveness. The empirical results of our study support this interpretation: team effectiveness is greater the higher the operational and dynamic competencies possessed by team members in the lowest quartile of members' MO competencies.

Implications

The results hold relevant implications for both academia and industry. First, from a managerial standpoint, the 'Shackleton principle' stresses the strategic advantage of identifying and empowering those team members who possess the strongest operational competencies for budget and deadline objectives. Concurrently, the 'weakest-link principle' reminds decision-makers that overall quality hinges on ensuring that even the least-skilled members have sufficient dynamic competencies, particularly in complex or rapidly changing environments. Firms could incorporate these principles into their HR policies by tailoring training, recruitment and professional devel-

opment programmes that add to both sets of competencies. Further, adopting 'diversity mindset' leadership training may help managers balance the need for strong operational leadership with the inclusive collaboration required for innovative, high-quality results. In this way, companies can optimise their cross-departmental executive teams to thrive amid shifting market demands and tighter project constraints.

From the research perspective, the paper highlights the importance of examining multiple theoretical aspects of team diversity (e.g., the effectiveness, firm performance, decision-making, team (social) structure and others). It also shows the relevance of studying complex interdisciplinary topics, which bridge economics and business, using a rigorous econometric and modelling approach. The discussion is also relevant for the study of self-managing teams in a flatter organisation, but in particular also for studying teams in a small company where ownership and management are typically not separated (see e.g., Prašnikar et al., 2017). Besides, as the management philosophies, strategies, and operations of not-for-profit and profit organisations are becoming increasingly intertwined (e.g., Gee et al., 2023), our study could be pivotal for analysing teams in a not-for-profit organisation. Similarly, the analysis can hold relevant implications for politics and its impact on development where cooperation between groups can impact social equilibria (e.g., Acemoglu & Robinson, forthcoming).

Limitations and future research guidelines

The nature of this paper and the data used also bring some challenges, which indicates potential for future research. First, the paper relies on a wide dataset, detailing team structure and results between 2006 and 2012. Although most results focus on exploring the fundamental relationships between competencies and performance, which should not be very time-specific, and the results should largely be generalisable across time, the pre-crisis and crisis periods were separated largely due to the impact of the 2008 Great financial crisis on the construction industry. While principles such as the 'Shackleton principle' and 'weakest-link-in-the-chain principle' are likely to remain applicable given that they constitute fundamental principles of team dynamics and goal achievement, their relative role across different types or origins of crisis could add value to the field. Second, the paper relies on data from only one sector. Accordingly, future empirical work would benefit from a comparative study testing the relative importance of both the 'Shackleton principle' and the 'weakest-link principle' across sectors. Future studies could study whether the interplay of operational and dynamic competencies holds in other industries or cultural contexts, potentially revealing new drivers of

project team performance. Moreover, researchers might explore longitudinal designs to observe how team competency distributions evolve over time and how leadership practices influence both routine (quantitative) and adaptive (quality-related) outcomes.

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NOTES

[1] Trimo, recently purchased by Recitel from Belgium, produces prefabricated steel structures for a range of purposes, mainly facades, roofs and containers for modular space solutions, yet also soundproofing systems (Trimo, 2019).

[2] Whether F1 and F2 have theoretical meaning after rotation is judged according to a meaningful interpretation of variables with the highest factor loadings.

[3] The results of other regressions are available upon request from the authors.

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Dvostruki pristup optimizaciji projektnoga tima: uravnoteženje učinaka "Shackletonova" i načela "najslabije karike"

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Ova studija raspravlja o učinku izvršnog međuodjelskog projektnog tima u odnosu na timske kompetencijske strukture. Istražuju se detaljne tržišno-orijentirane (TO) kompetencije članova tima i podaci o izvedbi. Empirijska analiza temeljena na teoriji marketinga odnosa i teorijama primijenjene psihologije pokazuje da su za postizanje proračunskih i vremenskih ciljeva prije svega bitne statičke kompetencije; dok su za postizanje ciljeva kvalitete bitne i dinamičke kompetencije. Štoviše, uloga distribucije snage kompetencija naglašena je tvrdnjom da su članovi tima s jakim TO kompetencijama važni za proračunske i vremenske ciljeve (Shackletonovo

načelo), dok najslabiji član ima ključan utjecaj na ciljeve kvalitete (načelo najslabije karike u lancu).

Ključne riječi: grupne odluke, timski učinak, Shackletonovo načelo, načelo najslabije karike u lancu