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Editorial

The mission of the *IJISPM - International Journal of Information Systems and Project Management* is the dissemination of new scientific knowledge on information systems management and project management, encouraging further progress in theory and practice.

It is our great pleasure to bring you the second number of the seventh volume of IJISPM. In this issue readers will find important contributions on project governance, project performance, Kanban, and IT governance.

The first article, "Governance, governmentality and project performance: the role of sovereignty", is authored by Ralf Müller. Considerable confusion prevails in the mutual positioning and relationship of concepts like management, leadership, governance and governmentality in projects. This article first develops a framework to distinguish these terms conceptually by use of Archer's structure and human agency philosophy. This provides for clearer conceptualization and lesser redundancy in the use of terms. Then the interaction between governance and governmentality in the context of projects is assessed, using a contingency theory perspective. This addresses long-standing questions about the nature of the impact of governance and governmentality on each other and on project and organizational performance. The results show that higher levels of project sovereignty (as a measure of governance), are associated with lower levels of authoritarian, but higher levels of neo-liberal governmentality, as well as higher levels of project and organizational performance. The article continues with a discussion of the theoretical implications from different perspectives of causality, which provides for different approaches to improve project performance through deliberate fine-tuning of governance and governmentality.

The title of the second article is "Performance measurement of complex project: framework and means supporting management of project-based organizations", which is authored by Eryk Głodziński. As the author states, performance management and measurement enable to improve strategy implementation and increase organizational competitiveness. The main objectives of the article are to propose a framework of project performance measurement and a set of measures that could be applied in project-based organizations. The framework considers performance assessment of the project and its context, including benefits occurring outside the project – on the program, project portfolio, and project-based organization levels – but being the result of project execution. The framework incorporates in project performance assessment the simultaneous and supplementary utilization of quantitative and qualitative measures, financial and non-financial measures that describe various fields of evaluation: finance, production, procurement, product quality, social, marketing of a product, legal, natural environment, client, and other stakeholders' satisfaction.

The third article, authored by Daniel Smits and Jos van Hillegersberg, is entitled "Evaluation of the usability of a new ITG instrument to measure hard and soft governance maturity". IT governance (ITG) has stayed a challenging matter for years. Research suggests the existence of a gap between theoretical frameworks and practice. Although current ITG research is largely focused on hard governance (structure, processes), soft governance (behavior, collaboration) is equally important and might be crucial to close the gap. The goal of this article is to evaluate the usability of a new ITG maturity instrument that covers hard and soft ITG in detail. The authors have conducted ten case studies and evaluated the instrument positively on usability. It is demonstrated that combining the instrument with structured interviews results in an enhanced and usable instrument to determine an organization's current level of hard and soft ITG.

"Using a coach to improve team performance when the team uses a Kanban process methodology" is the fourth article and is authored by Ivan Shamshurin and Jeffrey S. Salt. Teams are increasing their use of the Kanban process methodology across a range of information system projects, including software development and data science projects. While the use of Kanban is growing, little has been done to explore how to improve team performance for teams that use Kanban. One possibility is to introduce a Kanban Coach (KC). This article reports on exploring the use of a Kanban

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Coach, with respect to both how the coach could interact with the team as well as how the use of a coach impacts team results. Specifically, the article reports on an experiment where teams either had, or did not have, a Kanban Coach. A quantitative and qualitative analysis of the data collected during the experiment found that introducing KC led to significant improvement of team performance. Coordination Theory and Shared Mental Models were then employed to provide an explanation as to why a KC leads to better project results. While this experiment was done within a data science project context, the results are likely applicable across a range of information system projects.

We would like to take this opportunity to express our gratitude to the distinguished members of the Editorial Board, for their commitment and for sharing their knowledge and experience in supporting the IJISPM.

Finally, we would like to express our gratitude to all the authors who submitted their work, for their insightful visions and valuable contributions.

We hope that you, the readers, find the International Journal of Information Systems and Project Management an interesting and valuable source of information for your continued work.

The Editor-in-Chief,

João Varajão

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João Varajão is currently professor of information systems and project management at the *University of Minho*. He is also a researcher of the *ALGORITMI Research Center* at the *University of Minho*. Born and raised in Portugal, he attended the *University of Minho*, earning his Undergraduate (1995), Masters (1997) and Doctorate (2003) degrees in Technologies and Information Systems. In 2012, he received his Habilitation degree from the *University of Trás-os-Montes e Alto Douro*. His current main research interests are in Information Systems Management and Information Systems Project Management. Before joining academia, he worked as an IT/IS consultant, project manager, information systems analyst and software developer, for private companies and public institutions. He has supervised more than 100 Masters and Doctoral dissertations in the Information Systems field. He has published over 300 works, including refereed publications, authored books, edited books, as well as book chapters and communications at international conferences. He serves as editor-in-chief, associate editor and member of the editorial board for international journals and has served in numerous committees of international conferences and workshops. He is co-founder of CENTERIS – Conference on ENTERprise Information Systems and of ProjMAN – International Conference on Project MANagement.

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VIEWPOINT

Governance, governmentality and project performance: the role of sovereignty

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Governance, governmentality and project performance: the role of sovereignty

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Viewpoint

Abstract:
Considerable confusion prevails in the mutual positioning and relationship of concepts like management, leadership, governance and governmentality in projects. This article first develops a framework to distinguish these terms conceptually by use of Archer's structure and human agency philosophy. This provides for clearer conceptualization and lesser redundancy in the use of terms. Then the interaction between governance and governmentality in the context of projects is assessed, using a contingency theory perspective. This addresses long-standing questions about the nature of the impact of governance and governmentality on each other and on project and organizational performance. The results show that higher levels of project sovereignty (as a measure of governance), are associated with lower levels of authoritarian, but higher levels of neo-liberal governmentality, as well as higher levels of project and organizational performance. The article continues with a discussion of the theoretical implications from different perspectives of causality, which provides for different approaches to improve project performance through deliberate fine-tuning of governance and governmentality.

Keywords:
project governance; governmentality; project performance; organizational performance; sovereignty.

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1. Introduction

The academic discourse in the field of project management research continues to expand. The most obvious developments are from structural, or *hard management* approaches, to merely human, or *soft management* approaches. This development started in the 1950s with the so-called modern project management, where the focus was primarily on the managerial aspects, with planning and control techniques, such as PERT (Program Evaluation and Review Technique) [1]. Several decades later, about the turn of the millennium, this was complemented by the human side of management with a growing awareness of the important role of leadership in projects [2]. Around the same time, another stream of literature started to emerge, which addressed the theme of project governance as a structural way to steer projects and their managers for better project results [3]. This stream was subsequently complemented by publications on the human side of governance, that is, the subject of governmentality [4]. This development is indicative of a diversification in the understanding of projects and their management, done by adding new and widening existing perspectives, as well as increasing the granularity of each perspective with the ultimate aim to improve project and with that organizational results.

This growing granularity in understanding of these terms pervades the practitioner and academic community in project management in an unequal manner. Examples include the interchangeable use of the terms management and leadership in organizations [5][6], whereas publications that aim for a deliberate distinction between management and leadership define the former as a task related activity [7] and leadership as an interpersonal, person-oriented, social influence [8]. Similarly blurred is the use of the terms governance and management, whereby recent developments indicate a tendency to use the term governance for describing parts of traditional management tasks instead of the particularities of the structural framework thereof. These exemplary cases indicate the growing need for a clearer positioning of the terms (and their underlying concepts) against each other. Moreover, a clarification of the distinct nature of each of these terms should be empirically supported in order to give examples on how to apply them more deliberately and appropriately.

To that end, we pose two research questions:

R1: What is the difference of the terms/concepts of management, leadership, governance and governmentality in the realm of projects?

R1.1: What is the relationship between governance and governmentality and their combined relationship with project performance?

We do not empirically investigate the relationship between management and leadership and their combined relationship with project performance, as this was already done in earlier studies [9][10][11].

The first part of the present article develops a conceptual framework to distinguish between the four terms mentioned above using Archer's [12] Realist Social Theory and its distinction between structure and human agency. The second part of the article applies two of the lesser researched concepts, namely governance and governmentality in projects, to empirically investigate their combination with different levels of project and organizational performance. This provides for a better understanding of the particular roles of these somewhat new elements of investigation in the realm of projects. The empirical study uses the concepts of project sovereignty as a proxy measure for governance and as unit of analysis. The investigation takes a critical realism stance in the sense of Bhaskar and colleagues [13], which is also the underlying philosophy of Archer's Realist Social Theory.

Practitioners benefit from the article by gaining a better understanding about the different nature of the four concepts and the nature of the governance and governmentality interaction for project and organizational performance. Academic readers benefit from a clearer structure to distinguish the terms/concepts and the theoretical implications derived from the investigation into the roles and relationships of the concepts.

The article continues by building a conceptual framework by positioning the concepts of management, leadership, governance and governmentality against each other. Subsequently the methodology of the empirical investigation is described and the particular profiles of governmentality and performance at different levels of governance are

described. This is followed by a discussion of the theoretical implications from different causality perspectives. The article finishes with the conclusions of the study.

2. Building the conceptual framework

One way of positioning the concepts of management, leadership, governance and governmentality is by looking at them from a sociological perspective (Figure 1). Many sociologists agree that two basic concepts prevail in all forms of societies, including organizations or projects. These are structures and human agency. Structures are known for example, in form of job role descriptions, policies, processes, etc. in organizations. Structures are intended to be objective and rational by nature. Human agency describes the behavior of people within these structures. It represents the human subjectivity in response to structures [14][15]. Sociologists discuss the relationship between structure and human agency, which originally assumed a dominance of one over the other in various ways. Among them, Archer suggested that the two concepts are inseparable and mutually constitutive, hence each of them can only be understood in light of the other [12][14]. Their relationship is grounded in an ontological difference, whereby human agency possesses the self-reflective capabilities that structure lacks. Hence the implementation of the structural demands is mediated by human agency [15], which gives raise to a contingency theory perspective. Applying this distinction between structure and agency as a philosophical lens to the four terms of management, leadership, governance and governmentality, classifies:

- *Management* with its traditional understanding as a *task-oriented* activity in order to accomplish planned results (e.g. plan, implement and control). It is a *structural* means for *execution* of 'getting things done by others'. Management is often referred to as being rational, numbers driven, as well as associated with objectivity in planning and control in pursuance of efficiency in execution of an endeavor [16].
- *Leadership* as an interpersonal, and person-oriented process [8], hence a *people-oriented* activity to accomplish planned results at the same *execution* level as management, but in form of *human agency*. Leadership describes what goes on between people, including human action and subjectivity. In his studies on the physiological base of emotional intelligence in the human brain, Goleman [17], showed that the difference between leadership and management is even physiological. The rational management tasks mainly stimulate the prefrontal area of the human brain, which is the youngest part of the brain, whereas the interpersonal leadership tasks stimulate the emotional center of the brain, named the amygdala, one of the oldest parts of the human brain. Therefore, management and leadership complement each other in our efforts to accomplish objectives.
- *Governance* as a *framework for managers* to perform their task and hold them accountable for their work, thus a *structural* means to *steer* managers [18]. Governance relates to management as an objective and rational structural means to organizing in societies, such as firms or projects. Hence, it is at another level than the execution-oriented management tasks, as it frames the does and don'ts of it.
- *Governmentality* as the ways in which those in governance roles (i.e. governors) interact with those they govern. Hence, a *human agency*, reflecting the governors' mentalities and rationalities towards those they govern during the implementation, maintenance and change of governance structures. Similar to governance, it is an activity to steer managers, hence at the steering level.

Figure 1 shows the relative positioning of terms, within the framework of structure and agency, as well as steering and execution. This answers research question 1.

	Structure	*Human Agency*
Steering	**Governance** The framework for managers to do their tasks, and held accountable for it	**Governmentality** Governors' chosen ways of interaction, with those they govern
Execution	**Management** Goal oriented activity to accomplish (project) objectives	**Leadership** People oriented activity to accomplish (project) objectives

Fig. 1. Mutual positioning of management, leadership, governance and governmentality

3. Governance, governmentality and performance

3.1 Governance

The framework in Figure 1 identifies governance as a structure to steer management. Similarly, OECD defines governance as the means by which organizations are directed and their managers held accountable for conduct and performance [19]. For that, governance provides the structure to define the objectives of an organization, it provides the means to achieve those objectives, and it controls progress [20]. Within the realm of projects, governance exists at several levels: a) at the top of the organization as that part of corporate governance that decides on the particular part of the business that is done by projects; b) within middle management as *governance of projects*, where the entirety of projects, or subsets thereof, are governed and decisions are made on the commonalities of approaches across projects, such as methodologies, reporting practices, training, etc.; and c) at the individual project level in form of *project governance*, where decisions are made on particularities of the individual project [21][22]. These differences are crucial as they strike the balance between standardized practices required for efficiency in managing the organization, and idiosyncratic practices required to enable successful management of unique undertakings.

Governance measures are manifold, and vary widely [23]. One of the basic principles of governance, which is not very often used in project related studies, is that of *sovereignty*. It denotes the supreme power and rights for autonomy required for mutual recognition and control of governed entities. The concept is traced back to the "Peace of Westphalia" in 1648, where it described the member states' rights for autonomy, mutual recognition, and control [24]. Today it is typically defined in terms of internal control, external autonomy, and authority, such as "the right to rule over a delimited territory and the population residing within it" [25].

In project-based organizations it addresses projects' right for autonomy, as standalone, mutually recognized and respected entities, which reciprocally control each other, for example, by sharing resources [26][27]. Here sovereignty overlaps partly with the concept of project autonomy [28], but through its inclusion of mutual recognition and external control it becomes wider in scope. Moreover, autonomy is typically granted by an institution of higher level authority, while sovereignty is typically claimed by the institution in question [29]. To that end, sovereignty measures the extent the project managers claim power and autonomy among peer projects, which is a more realistic measure than the formally granted autonomy, which may not be followed in project reality.

Earlier studies using sovereignty as a measure of governance did not investigate the particular patterns of governmentality and performance emerging at different levels of sovereignty. This is done in the present article.

3.2 Governmentality

Just as all management needs some level of leadership, so does sovereignty needs to be accompanied by a human agency dimension to ensure people's 'buy-in' to the chosen governance approach. This human dimension is governmentality.

The word governmentality is a combination of the words *governance* and *mentality*. It was coined by the French semiologist Roland Barthes [30] in 1957 to describe the different ways in which those in governance positions present themselves to those they govern. This way of presentation reveals the attitude and mentality they have towards the governed people. Dean [31] defines three governmentality approaches:

- *Authoritarian governmentality*: Governors (such as members or chairpersons of project steering committees) clearly articulate to the project manager their expectations in terms of the means and ends in the management of projects. This is often found in organizations with well developed project management methods, but also in those with a preference for centralized decision making, clearness in directions and significant power distance, such as in major pubic investment projects [32].
- *Liberal governmentality*: Governors draw on the rationality and economic thinking of the managers they govern, for example, by use of incentives. This is exemplary for governance institutions that build on heterogeneity of governance approaches, for example, by using economic principles and market awareness to drive rational decision making by managers. This is often found in customer-delivery projects [33].
- *Neo-liberal governmentality*: Those in governing positions build on the self-governance of managers by setting the values of the organization in a way that makes managers steer themselves in directions that are desired by those who govern. This approach to governmentality builds on the managers' collective interests and willingness to consent. By the setting of the contextual frameworks, managers' behavior is shaped, but not determined [34]. Examples include community governed open-source development projects, where managers subscribe to an ideology and steer themselves in line with the value system of the organization [35].

Authoritarian and liberal approaches are direct approaches, based in interaction between governors and managers, whereas neo-liberal governmentality is an indirect approach which works through the environment of each manager [36]. Hence, neo-liberal governmentality becomes effective through cultural design [37]. Prior studies showed variances in expressions of authoritarian and neo-liberal governmentality at different levels of project and organizational success. However, the interaction of these concepts with sovereignty for project and organizational performance has not been assessed so far.

3.3 Project and organizational performance

The influence of governance on performance is intuitively valid, as the steering of project managers in desired directions of project performance links logically with better organizational results. However, there is little empirical evidence for it. Studies in general management [e.g. 37], as well as studies in project management [e.g. 38] repeatedly showed a lack of empirical evidence for this. One of the rare studies on the relationship between governance, governmentality and project success identified governmentality as an independent variable that has direct impact on project success, with governance being a moderator variable that represents the structural context and impacts the governmentality – success relationship [27]. This moderation takes place through a stronger governmentality – success relationship in the context of trust as governance mechanism (representing a stakeholder theory approach to governance), as opposed to a weaker relationship in the context of control as governance mechanism (representing agency theory approaches to governance).

Organizational performance relates relatively weakly to project performance. Only 28% of organizational performance can be traced back to project performance [27]. Hence, it is worthwhile identifying to what extent the "fit" between governmentality and governance impacts the wider organizational results.

Contingency theory suggests that the maximization of the value of a dependent variable (such as project performance) is influenced by the 'fit' between the state of the independent variable (such as governmentality) with the context variable (such as governance) [40]. Hence, governance is the ultimate independent variable, because it controls to what extent governmentality is allowed to influence project performance. Hence, the interaction of governance and governmentality is decisive for the impact of the steering level on project performance. Thus, neither governance nor governmentality alone are most decisive for performance, it is their interaction and particular combination that impacts project performance. To that end, we pose the following hypothesis:

H1: Different levels of sovereignty relate to different patterns in the combinations of authoritarian and neo-liberal governmentality, as well as project and organizational performance.

Project performance is one of the classic themes in project management research. Most often used synonymous to project success. However, success is typically measured at the end of the project, whereas performance can also be measured over the project-life cycle. Metrics used for both are often the same, but grew in variety over time [41]. Generic measures were developed staring from a focus on hard measures, such as time, cost and scope accomplishments in the 1980s [42][43] to more balanced measures, which added softer dimensions, such as team-satisfaction and end-user satisfaction [44].

The exiting literature shows insufficient evidence to answer research question 2 in light of the role of sovereignty as governance measures.

4. Methodology

An exploratory deductive study was done as part of longer-term mixed methods investigation. This wider investigation started with a conceptual and qualitative study to define the measurements for governance, governmentality, as well as project and organizational performance [26]. This was followed by a quantitative study to identify the relationship between governance, governmentality and their combined impact on project and organizational performance [27].

The present study investigates the role of project sovereignty as a proxy for governance in the combination and expression of authoritarian and neo-liberal governmentality in projects and their performance. The studies are executed taking a critical realism perspective which assumes a mind-independent reality where underlying mechanisms are assumed to give rise to particular events, which then give rise to human experiences [45]. This combination of views from underlying objectivism to experienced subjectivism provides for the identification of possible trends, but not necessarily generalizations of results or a singular explanations of a phenomenon [46].

A worldwide-questionnaire in the quantitative study described above yielded 125 responses, which are analyzed in the present article. The details of the measurement constructs can be found in [27] along with the approach to data collection, the demographics and descriptive statistics of the sample. Hence validity and reliability are achieved through use of tested constructs and Common Method Bias issues [47] were addressed following the approaches listed in [27].

The variables were measured on five-point Likert scales, using the following:

Authoritarian governmentality was assessed through questions on the steering committees' level of enforcing their decisions and being authoritative in style. Neo-liberalism by the extent the steering committees communicate values, fosters self-control, and empowers project managers. Both measures were on 5 point Likert scales, individually factor analyzed and the respective factors used herein with both having a mean of zero and a standard deviation of 1, together with a skewness and kurtosis below 0.8. Authoritarian governmentality showed a minimum of -2.842 and a maximum of 2.302, neo-liberal governmentality a minimum of -2.490 and a maximum of 2.321.

Sovereignty was measured as the role that the project manager assumes. Three roles were distinguished (from low to high sovereignty): a) *employee*, the project manager aims to fulfill tasks in a merely prescribed manner (e.g. process compliance); b) *manager*, the project manager claims a proportionate decision-making authority, expressed in a merely risk averse behavior [48] using professional and predictable decisions making heuristics [49]; and c) *entrepreneur* the project manager assumes a wide range of behaviors, such as risk taking and being a rugged individual [50], being

responsible for the project in its entirety as a business, free to decide on behalf of the project, only constrained by the limitations set by the governing institution. The measures were factor analyzed into a single, with a minimum of -2.846 and a maximum of 1.758, as well as a skewness and kurtosis below 0.7.

Performance at the project level was measured using ten items which balanced soft factors, such as customer satisfaction, and hard factors, such achievement of time, cost, scope objectives. The mean value was 4.124, with a minimum of 1.667 and a maximum of 5.0000; skewness of -0.972 and kurtosis of 0.198. Organizational performance was measured by ten items, of which three items measured performance at each of the levels of project, program, and portfolio, plus one overarching question on organizational performance. A mean value was 3.662, with a minimum of 1.000 and a maximum of 5.000, skewness of -0.657 and kurtosis of -0.120. Further details of the sample, its demographics and descriptive statistics can be found in [27].

The factors described above were used in the present analysis, together with normalized measures for the performance variables.

5. Analysis

5.1. The interaction of governance and governmentality

Earlier studies showed that governance and governmentality interact for performance [27]. To understand the nature of this interaction the variables for authoritarian and neo-liberal governmentality, as well as project and organizational performance were measured at two levels of governance, that is, at low and high levels of sovereignty. Figure 1 shows the results, with low sovereignty on the left and high sovereignty on the right. The measures for project and organizational performance were both higher in cases of high sovereignty, with project performance increasing significantly (at $p \leq 0.05$) when moving from low to high sovereignty.

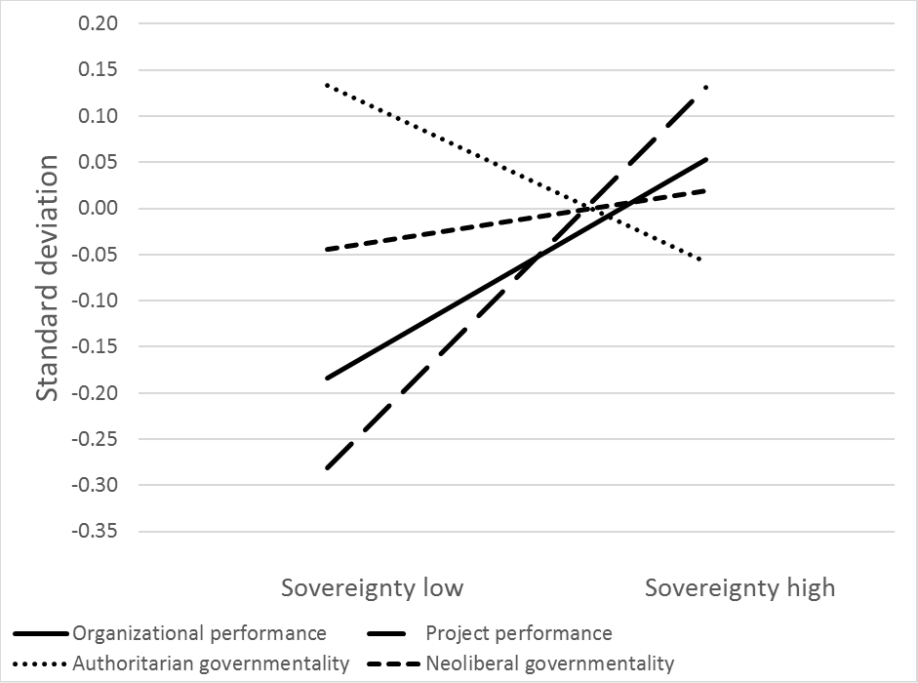

Fig. 2. Interaction of governance, governmentality and performance

5.2 Higher sovereignty – higher performance

Figure 2 shows the differences in patterns at different levels of sovereignty. High sovereignty in governance is associated with higher than average levels of neo-liberal governmentality and higher than average levels of project and organizational performance, paired with a lower than average level of authoritarian governmentality. The average is indicated by the 0.00 line on the y-axis.

Contrarily, in the context of low sovereignty, authoritarian governmentality is higher than average, and associated with lower than average levels of neo-liberal governmentality, as well as project and organizational performance.

The interaction of governance and governmentality become visible through comparison of low and high sovereignty practices. Low sovereignty implies that the project manager (and with it the project) is governed as a process, which necessarily needs to be followed, with little authority and freedom in decision making by those involved. The project manager claims a role as an employee, or at best as a manager, who has to act within the limits of the job description and with strongly limited decision authority. In this context, the steering of project managers develops from the authoritarian governmentality by the governance institution (typically the project steering committee). Little is there in terms of a neo-liberal value system that orients project managers in their decisions and allows for self-control. Project managers follow the orders from their steering committees.

The particular combination of low sovereignty, low neo-liberalism and high levels of authoritarian governmentality appears to be detrimental to the maximization of project and organizational performance measures. Hence, low sovereignty is not a context within which governmentality flourishes for better performance. It inhibits a project-level culture of self-thinking individuals and degrades professionals into receivers of orders.

High sovereignty appears to be supportive of maximizing project and organizational performance through governmentality. Here authoritarian approaches are reduced and neo-liberal governmentality takes over the steering of the project managers, who claim decision-making authority while simultaneously being accountable for the business approaches and results of their project. The project and its manager becomes an entrepreneurial entity, loaded with high risk, but also the autonomy and authority to deal with these risks and control them itself. These results support hypothesis H1.

6. Discussion

Interpretations of these results depend on the assumed direction of causality. Does governance/governmentality cause the level of performance, or does performance cause the particular combination of governance and governmentality? The following addresses both.

6.1 If the interaction of governance and governmentality impacts performance

Assuming that the particular combination of governance and governmentality impacts project and organizational performance, then projects should be governed as sovereign entities. Here projects are expected to act entrepreneurial and have the autonomy and authority to apply a wide variety of behaviors to handle the many different risks they are exposed to - all for the benefit of the project. This governance approach 'fits' best with a predominantly neo-liberal governmentality, where the governance institutions a) refrain from acting authoritative, b) set a democratic culture by communicating values and fostering self-control, and c) expect the project manager and team to decide for themselves, taking into account the collective interest of the project's stakeholders. The combination of high sovereignty and high neo-liberalism leads to high performance at both the project and the organizational level. This boils down to trust-based governance approaches, where governance institutions trust the project manager and team to act in the best interest of the project, hence the governance institution takes a stewardship perspective towards the project [51]. Stewardship theory proposes that (project) managers' motives are aligned with the objectives of their governing institutions. Moreover, managers are motivated by higher order needs and work intrinsic factors. Thereby identifying themselves with and are committed to the organization. Managers are assumed to prioritize the accomplishment of the organization's objectives over their own objectives, thus they are trusted to act pro-organizational and collectivistic

[52]. Therefore, they assume, and their governance institution grants them, widest possible freedom in the execution of their task.

6.2 If performance impacts the interaction of governance and governmentality

Assuming the contrary, that is, that performance is decisive for the choice of governance/governmentality combination, then two scenarios emerge. The first scenario is similar to the above. The good performance leads the governance institution to relax on giving orders and instead establish a set of organizational values that allow project managers to control themselves. A stewardship theory perspective from the governance institution prevails [51].

The second scenario is one of poor performance, where the governance intuition's trust in the project manager's success in accomplishing expected performance measures diminishes. Here the governance institution increases control and gives clear (authoritative) orders to the project manager in an attempt to ensure the 'right' things are done to manage the project. Such a context inhibits possible neo-liberal self-control values in the organization's culture and demands authority obedience. This boils down to control-based governance approaches, which are expressed as agency theory perspective by the governance institution. Agency theory assumes that managers are not trustworthy and/or susceptible to possible short-term gains for themselves at the expense of the project. Project managers are therefore not trusted by their governors and need strict control. Non-trust approaches to governance require the establishment of sophisticated control structures and their enforcement, which is expensive and adds to the costs of the project [53]. Moreover, these agency costs are typically not accounted for in project financing and add unexpected expenses to an already strained budget. Hence, the governance institutions and the project manager enter into a vicious downward spiral with little chance to recover from the situation. Examples for this are manifold, and frequently found in largely overspent public investment projects [51].

In organizations that impose their governance structure at the outset of a project without changing it over the project life cycle, it is reasonable to assume that governance/governmentality impacts (i.e. causes) performance as described above. This view is supported by the Organization for Economic Co-operation and Development (OECD) [54], or the investigation on governance impact on project results by Bekker and Steyn [55]. However, the relationship between governance/governmentality and performance can also be more reflexive and mutually adjusted over time. Here a change in performance can lead to an adjustment in governance/governmentality in the way described above, which gives rise to the possibility that the new governance/governmentality approach influence performance as described. A continuous change. This is desirable as long as the mutual influences reinforce positive developments for the project and its performance. In case of negative developments, the nature of the governance perspective (agency or stewardship) shall be assessed and a more trustful and stewardship based approach implemented, if possible. That may include an assessment of the resources engaged in the project in order to instill high levels of trust, mutual respect and motivation to carry the project forward in the desired direction.

7. Conclusion

This paper addressed the yet under-developed perspective of governmentality as the human counterpart to the more structural governance approaches in project-based organizations. For that, management and leadership were positioned as execution level counterparts to governance and governmentality at the steering level. This answered research question 1.

Then a prior study was extended which empirically identified governance as a context (moderating) variable and governmentality as directly influencing variable on project and organizational performance. The present study assessed the combination of governmentality measures, project and organizational performance at different levels of sovereignty. Low levels of sovereignty were indicative of low performance measures, low neo-liberal and high authoritarian governmentality. High levels of sovereignty were indicative of high levels of performance and neo-liberalism, and low level of authoritarian governmentality. This supports hypothesis H1 and answers research question 2.

Theoretical implications are elaborated in the discussion section, by linking the findings to underlying agency and stewardship perspectives, whereby the former is associated with lower levels of sovereignty and the latter with higher

levels thereof. Furthermore, the results were discussed from different directions of assumed causality, up the point of reflexivity and the suggested actions in these cases. Academics will find building blocks for governance theories and relationships in the discussion section.

The discussion section also addressed practical implications for the practicing managers and governors. Other practical implications include the need to make governmentality a subject of project management training, as it has been shown to have a stronger impact on project results than governance. To that end, the recommendations for governance and governmentality provided above will allow practitioners to apply governance and governmentality more deliberately and thus benefit from the findings for their own organizations.

The strengths of the study lies in the use of tested and published measures, which supports validity and reliability of the data and the findings thereof. Weaknesses are in the relatively small sample size, and the exploratory nature of study. More investigations are needed to validate and stabilize the findings, and address related research questions, like the impact of project sizes, sectors, or national cultures on the relationship of governance and governmentality for good performance. Moreover, future studies should address further measures of governance and governmentality and their interaction in order to build a comprehensive theory that allows for a more deliberate construction and use of governance structures and governmentality in human agency.

The article contributed to the discussion about the importance of governmentality as such, and the nature of the interaction of governance and governmentality for sustained performance in projects and organizations.

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Before joining academia, he spent 30 years in the industry consulting with large enterprises and governments in more than 50 different countries for better project management and governance. Projects he worked on span from small up to USD 5 billion in value. In these projects, he worked closely with AT&T and Bell Laboratories, USA. He also held related line management positions, such as the Worldwide Director of Project Management at NCR Corporation.

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Performance measurement of complex project: framework and means supporting management of project-based organizations

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Abstract:
Performance management and measurement enable to improve strategy implementation and increase organizational competitiveness. The literature review and desk research confirm that the design of a performance system is an issue because of the redefinition of project environment conditions and complexity of 4P. The system should be continuously developed during exploitation. Main objectives of the paper are to propose a framework of project performance measurement and a set of measures that could be applied in project-based organizations. The assessment proposal is the result of a literature review and qualitative empirical studies, interviews, and participatory observations. The framework considers performance assessment of the project and its context, including benefits occurring outside the project – on the program, project portfolio, and project-based organization levels – but being the result of project execution. The framework incorporates in project performance assessment the simultaneous and supplementary utilization of quantitative and qualitative measures, financial and non-financial measures that describe various fields of evaluation: finance, production, procurement, product quality, social, marketing of a product, legal, natural environment, client, and other stakeholders' satisfaction.

Keywords:
project; performance; measurement; framework; project-based organization; 4P.

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1. Introduction

The topics of performance management and measurement have been explored by numerous researchers for years [1]. It is a crucial issue for business practice due to obtaining shareholders satisfaction or managers' target evaluation. One of the most valuable performance definitions points out that it is "the process of quantifying the action (...), leads to performance (...) defined as efficiency and effectiveness of action" [2, p. 81]. Efficiency should be understood as optimization of the relation between outputs and inputs that were utilized to deliver them. Effectiveness is the extent to which the achieved results of an action meet our objectives (plans, expectations, requirements etc.). Amaratunga and Baldry highlight that "performance management provides organizations with the opportunity to refine and improve their development activities" [3, p. 218]. Bititci points out that "the cultural and behavioral routines define how we use the performance measurement system to manage the performance of an organization" [4, p. 29]. Following the presented approach, performance measurement can be defined as the process (or processes) of: setting goals, developing a set of performance measures, monitoring, collecting, analyzing and interpreting data, status reporting, reviewing and acting to enhance performance. It requires from employee more hard skills than the soft ones [5], from organization – more technical solutions such as frameworks, means, or supporting methods, rather than employee empowering or intuitiveness.

Performance management and measurement enable to improve organization competitiveness or adapt entity to changes. They support the translation of business strategy into operational activities [6]. Numerous academic studies in the field are supported by professional organizations, such as Performance Measurement Association (PMA) or European Institute for Advanced Studies in Management (EIASM), International Controller Association (ICA), International Performance Research Institute where knowledge and experience exchange can be observe. Nevertheless, there are still open issues such as exploring the nature of collaboration supporting the achievement of targets, defining the characteristics of performance indicators [7], designing the visual management system that could facilitate performance measurement and review [8]. The crucial aspect related to performance measurement is to design the solution that will follow managers' needs and to consider market conditions e.g. changeability, uncertainty, complexity of organization operations, or the trend related to protection of natural environment. It is still a relevant research problem to follow the assumption that "the leading indicators of business performance cannot be found in financial data alone. Quality, customer satisfaction, innovation, market share-metrics like these often reflect a company's economic condition and growth prospects better than its reported earnings do" [9, p. 131]. The outlined issues are becoming particularly visible in project environment [10] because undertaken activities are more and more complex and stakeholders expect continuous improvement of products. The effect of mentioned environment conditions is the increasing trend of projectization in various sectors of economies [11]. The process should be complemented by performance management and measurement supporting tools that need to be developed, predominately for project-based organization (PBO).

The paper has conceptual character. Its main objectives are to propose a developed framework of project performance measurement and a set of measures that could be applied in the presenting solution. In this context the following research question have been formulated:

- How to consider project indirect inputs and outputs in performance measurement?
- How to combine financial and non-financial measures?
- How to measure the financial and non-financial, project direct and indirect inputs and outputs related to Project Life Cycle?

Indirect inputs and outputs are understood as categories that occur outside the project (on portfolio or permanent organization levels) but are the result of project realization.

The study proceeds as follows. The first part presents the critical analysis of current research related to project performance management and measurement. Next, the assumptions for framework design and framework proposals of project performance measurement are described.

2. Project performance management and measurement: theoretical background

2.1 Project management performance and project performance

Performance in project environment can be divided into two various research objects - project performance and project management performance. Bryde demonstrated the differences between them in the context of quality. Quality of management process is the leading attribute of project management performance while the quality of the end product delivered by the project is associated with project performance [12]. Both categories are close interlinked.

Development of project management processes is commonly related to the increase in the project management maturity levels of PBO [13] that enhances the competitiveness of organizations [14]. Bryde demonstrated that project management performance is driven by: project management leadership, project management staff, project management policy and strategy, project management partnerships and resources, project management life cycle process, and project management key performance indicators [12]. The mentioned elements were utilized in PMPA model, a well-known project management performance evaluation framework that was created basing on EFQM Excellence Model [12, 15]. Numerous studies present the close relation between project management performance and project success, such as project efficiency, impact on the customer, impact on the project team, business success, preparing for the future or general stakeholders satisfaction [16]. The presented findings overlap the assumptions of project management factor research school [17] that indicates project success factors (drivers) as vital methods accomplishing project success. Concluding, project management performance is the mega process consisting of planning, monitoring, control, and support for decision making that is focused mainly on people behaviors, organization of work, existing or desirable regulations, efficient utilization of resources. The assessment of project management performance aims at answering the question 'how to deliver the product?'.

Project performance describes outputs related to product. They can be a product in progress or a final/completed product. Traditional approach associates project performance with evaluation of scope, quality, and cost [18]. Contemporary research proposes the focus on management of: benefits, requirements, scope and configuration, value, quality, organization, schedule, cost, resources, risk, health and safety, and environment [18-19]. The monitored elements should be measurable, which enables to plan and control them in the selected time range. Well-known project performance evaluation methods are EVM (Earned Value Management) [20-21], KPI (Key Performance Indicators), or Balance Scorecard [22]. In this context the analysis of project performance is "the process of comparing actual project cost and schedule performance to the performance measurement baseline for the purpose of analyzing the current status of a project" [23, p. 55]. Significant added value can by supplemented by various methods of project completion calculation [24]. It delivers the information required for invoices issuing and revenue recognition. Evaluation of completed project performance supports establishing benchmarks of high performance projects for cross-learning and identify inefficiencies [25].

Evaluation of project performance should be conducted from various contexts, direct project oriented outcomes (e.g. scope, quality) and indirect effects (e.g. natural environment). Such an approach is presented in Prince2 methodology where product delivery is a crucial aspect of managing [26]. Industry standard for construction extension proposes monitoring and control in the following areas: design, procurement, expediting, risk evaluation, quality activities, and forecast of future activities related to cost and earned value [27]. The large number of project performance drivers, their nonlinear dependencies and increasing volume and variety of data and information [28] trigger the utilization of project management software. The conducted research perceived that the less-performing projects present significantly lower IT/IS system utilization level than other projects [29-30].

Concluding, project performance is the mega process consisting of planning, monitoring, control, and support for decision making that is focused mainly on product parameters. It controls the fulfillment the requirements related to product: accepting a work package, executing a work package, and delivering a work package [26]. In the light of presented research findings and business practice performance project management should be treated as project performance driver (figure 1). It is one of the complex project success factors that directly and indirectly affects product

delivery in all stages of project life cycle. The framework of measurement of indirect project benefits is still an open issue.

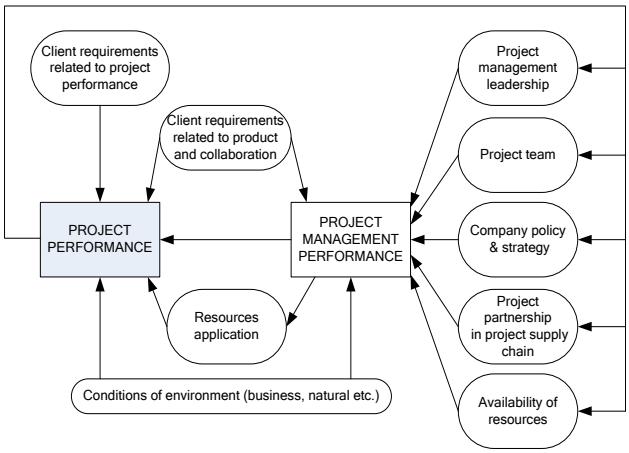

Figure 1. Significant drivers of project performance

2.2 Project performance organizational context

Looking at performance in project environment from the theory of organization – that describes project or program as a temporary organization [31-32] – four research subjects can be distinguished: project, program, portfolio, and project-based organization (PBO). The presented list follows traditional classifications of 3P (project, program, portfolio) [33] and supplements it by the fourth element (PBO) that creates the construct of 4P. The relations between the mentioned elements were comprehensively described in literature. Engwall demonstrated that single project cannot be treated as isolated entity [34], but it is affected by the complexity, risk and uncertainty of its context defined by the program, project portfolio and project-based organization of which project is a part [35]. They create one complex management system in organization being a part of its performance management and measurement system (figure 2).

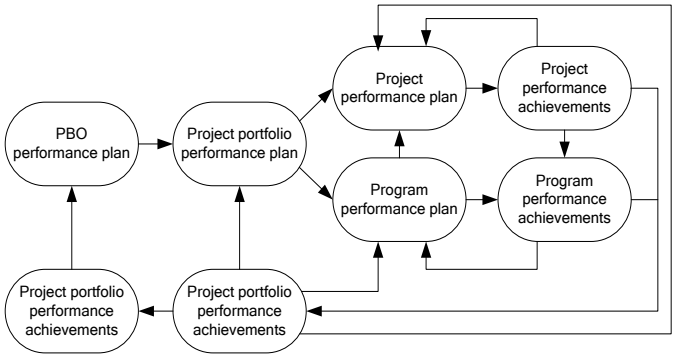

Figure 2. Correlation between 4P performance

Despite that, performance of each of the mentioned elements is driven by diverse factors. Some of them overlap, and others deviate. Next part of the paper describes project performance organizational context related to performance of program, portfolio and PBO.

Program performance is focused on creation of aggregated added value of projects being its part. It is not a simple sum of single project performance and could not been treated as a scale-ups of projects. Project performance monitors and controls results (outputs and inputs) that are direct contribution – in a foreseeable manner of short-term period – to

business success related to project or its product while program performance focuses on broader, fuzzier, and more indirect and far-reaching, long-term results [36]. Program managers are the first supervisors of project managers who control and support their performance. Patanakul and Pinto perceived that program management could be a navigation through political landscapes (especially in the public sector) and performance is limited by formalized communication and collaboration channels that are much more developed than on project level [37]. Project Management Institute defined five program performance domains: strategy-alignment, benefit management, stakeholder engagement, governance, and program life cycle management [38]. In that context the key differences between program and single projects are related mainly to early benefit realization (in some cases the opportunity to achieve benefits from completed projects before program completion), and the need of performance governance of cyclic delivery from various projects [39]. Summarizing, program performance measurement implements project solutions and supplements them by means that are strategy-oriented and empower governance.

Higher strategic level of performance management and measurement is related to project portfolio. By designing the system, it should be considered that group of projects conducted under the sponsorship or/and management of the permanent organization compete for its scarce resources [40-41]. Müller, Martinsuo and Blomquist categorized portfolio performance into four overlapping research areas: the relationship between portfolio management practices and performance, portfolio management performance, portfolio control, contextual factors associated with the relationship between portfolio control and portfolio management performance [35]. First, the presented study confirms that portfolio management performance is a driver of portfolio performance. Second, it emphasizes the crucial role of control functions that have to be supplemented by at least planning and reporting. Much wider approach demonstrated Project Management Institute that described six portfolio performance domains: capacity and capability management, stakeholder engagement, portfolio value management, risk management, strategic management, and governance [42]. The presented domains put attention inter alia on selection of portfolio elements. Its strategy-alignment is positively corelated with achieving permanent organization results [35]. In that context various types of metrics, such as financial and non-financial, should be utilized to present a comprehensive overview of portfolio added value. The researchers still observe existing gap in the fields [22].

All the above mentioned performance management and measurement systems are integrated on PBO level. They are a part of Organizational Project Management (OPM). PBO utilizes well known company performance ratios such as ROS, ROA, EBITDA, market share, brand recognition, and it supplements them by project oriented indicators inter alia project or program success, or portfolio backlog. The comprehensive assessment encompasses tangible and intangible benefits that in many cases are measured by indirect methods [43]. Numerous researchers perceive crucial role of Project Management Office (PMO) in implementation of the task [44-45]. It should support methodological improvement of performance measurement (what and how to measure) and the application of lesson-learned process (collecting and sharing experience, knowledge). PMO should be a unit that designs/redesigns or supports the design/redesign of measurement process and then it consults the project teams in project exploitation stage to ensure comparability of received data. However, few studies in the field of OPM explore the influence of other supporting departments, such as controlling, accounting, procurement or technical, on PBO's organizational effectiveness [see 46-47]. "Through the effective utilization of portfolio, program, and project management, PBO's have the capability to increase their potential to create value and, in some cases, directly increase the effectiveness and efficiency of the value creation itself" [43, p. 16].

2.3 Project performance assessment tools

The presented knowledge was utilized by researchers in the design of various project performance assessment supporting tools. They can be grouped into:

- Project performance evaluation methods [48-49], including evaluation of environmental or social aspects [50];
- Cost-benefits project assessments, capital investment appraisals or capital budgeting [51-53];
- Project measurement frameworks [54-55], and measures [56];

- Project assessment methods embedded in project management methodologies/methods that present the frameworks of monitoring and control processes, describe the techniques of project performance analysis, focus on fulfillment of the business needs [23, 26-27];
- Project evaluation process fully or partially funded by public institutions [57-58].

The mentioned tools constitute interesting and, in many cases, applicable proposals in business environment. Some of them were positively verified by market entities. However, there is still a gap related mainly to the consideration of indirect project benefits. The presented state of the art was the motivation for further empirical and conceptual studies.

3. Research method

The presented literature analysis demonstrates that there are still numerous research issues related to proper definition of project performance that consider environment uncertainty and complexity. In order to bridge the existing gap empirical studies were conducted. First the following methods of data collection were applied:

- Participatory observation of 13 projects (financial, IT, and development) conducted in large PBO operating in Poland (international company), where the observer participated actively as contractor (executor) or ordering party (client) over the last 10 years; the selection of the research sample was targeted and it resulted from a range of researchers' expert activity; during the observations the managers' experience and believes related to project control were collected;
- Unstructured interview that was conducted with 48 persons from large and middle PBO operating in: Germany, Poland, Singapore, the UAE, and the UK; the sample selection was targeted, as the main eligibility criteria were applied in the conjunction of at least one-year experience on the job in project teams and expert knowledge in the key areas for executing projects (planning, tendering, execution, monitoring, control etc.); the requirement of working as a manager was not applied, although it was assumed that the interlocutors should perform at least supervisory and control functions or they should conduct research in project management; the structure of the research sample by sector types was as follows: construction industry 26 persons, consulting sector 12 persons, IT 6 persons, others 4 persons; the goal of the interviews was to collect the managers' experience and believes how to conduct a project assessment, including analysis of project efficiency.

During and after the observations and interviews the notes were made on a regular basis. They included the crucial findings related to conducted business actions and their results, as well as description of interviewee experience, implemented solutions, and ideas. Next the coding using in vivo method was carried out. The codes and subcodes were related primarily to: qualitative and quantitative aspects of performance assessment, final and mid-term project assessment, project portfolio and company performance. The completed steps allowed to create the initial map of project portfolio assessment that was utilized to design a measurement framework and to propose a set of means. Here an academic theorization combined with induction and conceptual modeling processes were applied. They aimed at, inter alia performing taxonomy of main approaches and streams in the issue of efficiency, as well as designing a framework for assessment of project performance.

4. Performance measurement framework

4.1 Design assumptions and constrains

Before the design stage, having applied literature study and desk research, the following assumptions and constrains related to elaborated framework were made:

- Operational activities of Project-Based Organizations differ from other entities, therefore to increase their effectiveness and efficiency 4P performance system should be developed;
- PBO aims at improving the project maturity level that includes assessment of project and its context at program, portfolio and mother organization levels;

- Project performance measurement should consider various types of inputs and outputs occurring on each 4P levels;
- Set of performance measurement should encompass of financial and non-financial indicators; the presented approach follows the concepts of organization sustainable development which is promoted in the market;
- Measurement process should consider monitoring and control of direct inputs and outputs related to project and indirect inputs and outputs occurring on program, portfolio or permanent organizational levels.

4.2 Framework description

Considering the fulfillment of assumptions and constrains the following major discriminates in the designed framework (figure 3) were set:

- Two-stage performance assessment i.e. division into preparation (planning methodology & targets) and execution (monitoring, measuring, data collection, analysis, comparisons, concluding, and reporting), because the projects are not equal and enable adaptation of contingency approach [59];
- Two-level stage of execution assessment i.e. division into outputs and inputs analysis within the project, project portfolio and company levels, because some project benefits appear with time-lag or have influence directly on PBO, which enables adaptation of governance system.

The first stage of performance assessment is preparation for evaluation. That consists of: defining and prioritizing the assessment criteria and measures, designing methods/techniques of monitoring, measure analysis etc., planning the targets and result interpretation. The presented activities are usually connected with project acquisition (project tender) stage when managers adapt the project strategy into PBO's strategy. However, during the project execution some adaptation or improvement actions could be required. The first stage issue is related to description of means which is presented in the next part of the paper. The second issue is related to the target setting. Means and targets should follow PBO needs (financial and non-financial, direct and indirect) and consider project context – inter alia client requirements, competition level, project novelty, PBO's capacity and capability. The division of project outputs into various groups could support the assessment process. The following fields can be considered: finance, production progress (project completion), procurement, product quality, social, marketing of a product, legal, natural environment, client and other stakeholders satisfaction. All of them influence on project business value that is controlled by performance measurement system.

The second stage of performance assessment is related to project execution. It is divided into two levels – inside the project and outside the project that is related to inputs and outputs occurring in program, project portfolio, and the company. The recognized outcomes and incomes are used for inter alia analyzing the results of project manager's work by portfolio and company managers. However, it is necessary to emphasized that he/she must not maximize performance uncritically because the project context should be considered. Project strategy is a tool for implementing the strategy of the PBO. Therefore, it is important to communicate properly the occurring dependencies among the project, its program, project portfolio, and the company. The proper governance of performance management and measurement process is advocated. Its main role should be the project strategy-alignment to PBO through control of project target achievements and supplement them by inputs and outputs occurring on program, portfolio or company levels. It is called holistic project performance assessment. That consists of completing the assessment from the first level with outputs and inputs that have a dimension of impact wider than just the project. It involves inter alia sharing on time (according to the implementation timetable of the project) the proper: resources (people, equipment, capital etc.), knowledge related to business partners, technology etc., supporting management tools (budgeting, cost accounts, techniques of risk evaluation, information channels etc.), organizational support executed by project management office and other departments, such as accounting, procurement, human resources, research & development etc.

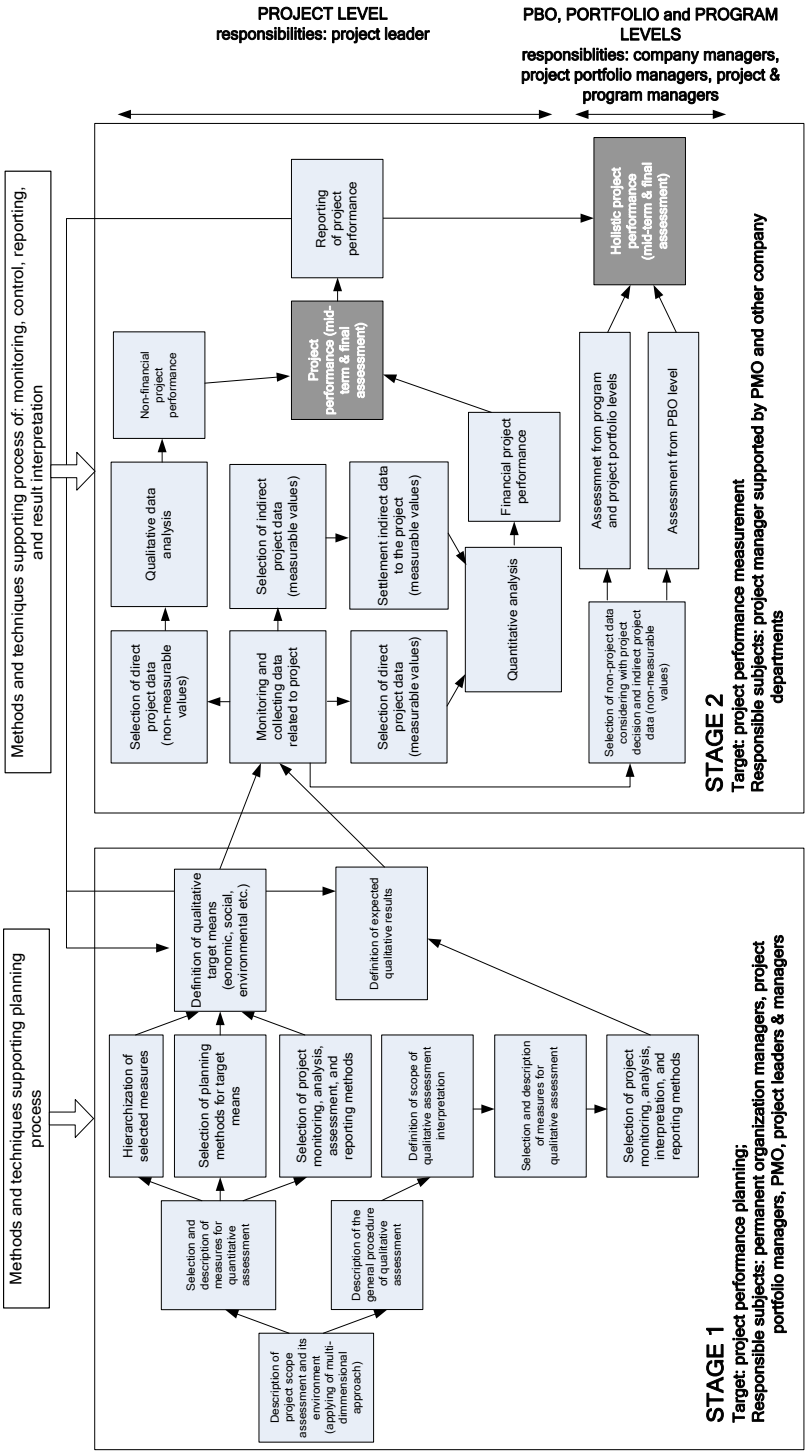

Figure 3. Project performance assessment framework applicable by PBO (based on [61])

The conducted observations indicate that top decision-makers in PBO do not appreciate the supporting role of governance in performance achievement [62]. It is one of the reasons for lack of project success (failing to achieve the expected efficiency level). A holistic assessment of performance involves comparing the achieved outputs (direct or indirect that are recalculated to the project) and the incurred inputs, as well as completing the context of operations and assessment, including the support given by PBO.

4.3 Project performance measurements

There are crucial issues related to adaptation of the presented framework in business environment. The first one is the consideration and common interpretations of qualitative and quantitative, financial and non-financial measures/factors on each level (project, portfolio, and organization). The second one refers to utilization of separate or aggregated measures applied on various 4P levels. The third encompasses consideration of direct and indirect project outputs and inputs. According to literature review [39-40] and conducted empirical research some measures are recommended:

- In a group of financial means: tender costs, manufacturing costs, overhead costs, financial costs and revenues, decrease in manufacturing costs, incomes from the client and other parties, invoiced work done, not-invoiced work done, various types of results, Net Present Value, Payback Period, incoming and outgoing payments, increase or decrease in asset value, opportunity to use the surplus of project cash flow to another project, covering the organization fix costs by project overheads, etc.;
- In a group of non-financial means related to project level: work done, percentage of completion, development of project team members, procurement results, product quality, client and other project stakeholders satisfaction, etc.;
- In a group of non-financial means occurring on non-project level: work done secured of PBO, resource utilization, volume of contracted works (ending order backlog), effectiveness of tender, client attachment (repetitive collaboration), benefits from marketing activities, result of lawyer's activities, employee development opportunities, employee satisfaction, client references, volume of emissions and produced waste, etc.

The process of selecting the presented measures is a crucial one. It should be executed according to company management system requirements and has to be in line with organization strategy e.g. rather social than financial aspects. However, combining various measures appears to be the dilemma of a common interpretation and consecutive use of qualitative and quantitative measures. It may be limited by applying standardization methods whenever possible (valuation of outputs and inputs in the same unit of measure). However, one must not rigorously pursue transforming qualitative evaluations into quantitative ones, especially when they have a descriptive form. They may be treated as complementary to other evaluations, placing them in the decision-making context. It is vital, since result interpretation usually depends on the perspective, that the analysis is conducted. It is necessary to be aware of it for the evaluator and evaluee in order to maintain the evaluation impartiality. The interpretation of the evaluation context and combining it with project performance indicators should not be subject to parametrization. One needs to rely on the experience of decision-makers, their business premonition and the ability to predict the future.

Looking into the dilemma of data aggregation, it must be emphasized that there is no need to aim at creating aggregate evaluation of all the tested variables. However, such an activity may and should be undertaken whenever possible. Basing on the conducted observations, one may conclude that the preferred method of indicator aggregation is to create a weighted average or median. Its advantage is the simplicity of use that is particularly important in business activity. However, mid-term assessment is as important as aggregated one. It helps to understand the context of data interpretation and prepare better response actions.

5. Conclusion

The literature review indicates that the knowledge in the field of project performance management and measurement is comprehensive but reveals some additional gaps. They are related to new conditions of project environment. The conducted empirical study and designed framework completed the existing knowledge. The presented framework

proposes the simultaneous utilization of quantitative and qualitative measures in assessment of project performance. The qualitative description especially of the outputs enables to understand context of the project. In order to consider both proposals the assessment process was divided into two stages – preparation and active assessment. In both stages monitoring and control on project and non-project levels (program, portfolio, and PBO) are planned and conducted simultaneously and supplementary since project direct and indirect outputs thereof benefits and inputs should be taken into account. Such a process starts since the beginning of tender phase till completion – also in warranty period.

Designing the measurement systems in various fields should be considered. The crucial recognized areas are: finance, production, procurement, product quality, social, marketing of a product, legal, natural environment, client and other stakeholders satisfaction. Financial measures should be aggregated (if possible) from project to PBO levels while non-financial in most cases treated as a context of project delivery. The assessment of the context might change the perception of mid-term or final results.

The presented framework has some limitations. Firstly, PBOs that want to apply the framework should possess high level of company project maturity and endeavour to its increase. This is required because the presented assessment process needs complex standardization that supports collecting reliable data and quality information from various sides of the organization. Secondly, the assessment is not fully parameterized and enables some qualitative evaluations. Highest competences of managers are here required. Thirdly, the proposal was positively verified only in one big construction company and needs further adaptations also in other industries. Fourthly, the proposed framework needs some IS (Information System) support that is crucial driver of organization development [64]. The paper did not discuss the issue.

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Evaluation of the usability of a new ITG instrument to measure hard and soft governance maturity

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Abstract:
IT governance (ITG) has stayed a challenging matter for years. Research suggests the existence of a gap between theoretical frameworks and practice. Although current ITG research is largely focused on hard governance (structure, processes), soft governance (behavior, collaboration) is equally important and might be crucial to close the gap. The goal of this study is to evaluate the usability of a new ITG maturity instrument that covers hard and soft ITG in detail. We conducted ten case studies and evaluated the instrument positively on usability; but feedback also revealed that the assessment questions needed improvements. We demonstrate that combining the instrument with structured interviews results in an enhanced and usable instrument to determine an organization's current level of hard and soft ITG. We conclude that this new instrument demonstrates a way to reduce the mismatch between ITG maturity theory and practice.

Keywords:
IT governance; IT governance maturity; soft governance; hard governance; design science.

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1. Introduction

When IT governance (ITG) or corporate governance go awry, "the results can be devastating" [1]. The bankruptcy of Enron in 2001 and other scandals at Tyco, Global Crossing, WorldCom and Xerox resulting in the enactment in the United States of the Sarbanes-Oxley Act are just a few examples. Employees, customers, suppliers and local societies suffered severe losses owing to managers driven by the possibilities of creating personal wealth through dramatic increases in the market prices of their shares [2].

The impact of ITG on firm performance have been well-established in previous studies, yet there remains a gap explaining exactly how ITG influences firm performance [1]. ITG is positively related to business performance through IT and business process relatedness [3], [4]. Weill and Ross [5] present another excellent example of the linkage between ITG and corporate governance with corporate and IT decision-making. A third example comprises the relationship between corporate governance and ITG of Borth and Bradley [6], in which ITG is presented as one of the key assets to govern.

Improving ITG is difficult because it is a challenging, complex topic. ITG is complex because it is not only about organizational processes and structures but about human behavior too. We look at ITG from two perspectives: an organizational perspective referred to as "hard governance" and a social perspective referred to as "soft governance". In traditional ITG research and frameworks the main focus was hard governance, sometimes defined as "structures and processes". Social elements were not completely out of focus but many researchers favored generalizations like "social integration" [7] or "relational mechanisms" [8]. The social or human interactions in organizations are much more complex than organizational structures and processes and need at least the same amount of consideration in models or frameworks. This rarely happens in ITG research. This however is the focus of our research and the distinction between hard and soft governance is becoming more common in ITG research [9]-[14].

The purpose of this study is to demonstrate and evaluate the usability of a new ITG instrument to measure ITG maturity in an organization. This is an assessment instrument that can be used to measure hard and soft ITG maturity in detail. Our approach is grounded in the assumption that improving "ITG maturity" results in improving ITG and thus firm performance.

This paper is organized as follows. This section introduces the purpose of this study. The next section introduces the topics of hard and soft ITG and ITG maturity. Section 3 presents the research methodology. The results of the case studies are described in Section 4. Section 5 covers the discussion. The conclusion, limitations and implications for future research are included in Section 6.

2. IT governance

In this section we introduce hard and soft ITG and ITG maturity.

2.1 Hard and soft IT governance

ITG is a relatively new topic [8], with the first publications appearing in the late 1990s. Although a considerable body of literature on ITG exists, definitions of ITG in the literature vary considerably [15], [16]. There simply does not seem to be a common body of ITG knowledge or a widely used ITG framework. An analysis of the ITG literature reveals that six streams of thought can be distinguished [17]. Four ITG streams differ in scope: "IT Audit", "Decision making", "Part of corporate governance, conformance perspective", and "Part of corporate governance, performance perspective". The last two streams differ in the direction in which ITG works: "Top down" and "Bottom up".

In practice, organizations use all kinds of frameworks or methods for ITG. Frameworks are the most important enablers for effective ITG [18]. A variety of frameworks devised for improving ITG exists [19]. The list of frameworks frequently used for ITG vary considerably, as can be seen in several global surveys from the ITGI addressed to 749 CEO-/CIO-level executives in 23 countries [18], [20]. Best practice frameworks are the most important enablers for

effective ITG. Other enablers include toolkits, benchmarking, certifications, networking, white papers and ITG-related research. Some of the frequently cited frameworks comprise COBIT, ITIL, ISO/IEC 17799, ISO/IEC 27001, ISO/IEC 38500 and BS 7799 [21].

Except for COBIT and ISO/IEC 38500, these frameworks are not ITG-specific. The ISO/IEC 38500 standard comprises a set of six principles for directors and top management: responsibility, strategy, acquisition, performance, conformance and human behavior [22]. However, there is "no specific and well defined exemplar framework and standard for IT" [23]. That makes it insufficient for implementation in practice. Although COBIT's scope has increased over the years, accounting and information systems are the predominant domains related to COBIT [24].

A well-known classification comprises the three layers of Peterson et al. [7]:

- Structural integration;
- Functional integration;
- Social integration.

In 2004 this became better known (and somewhat simplified) as the trichotomy of structure, processes and relational mechanisms [8]. This classification may be concise and practical, but as among others Willson and Pollard [25] have shown, ITG is not limited to structure, processes and mechanisms; it also relies on complex relationships, between history and present operations. Furthermore, cultural and human aspects are some of the factors that had the greatest influence on the implementation of ITG by 50% of the participants of a large global survey conducted by ITGI [18]. Thus, in this study, we look at ITG from two perspectives: a "hard governance" perspective and a "soft governance" perspective.

Hard governance

Hard governance is related to structural integration and functional integration:

- *Structural integration*: formal structural mechanisms with increasing complexity and capability, ranging from direct supervision, liaison roles, task forces and temporary teams to full-time integrating roles and cross-functional units and committees for IT [7], [26], [27]. Informal structural integration comprises unplanned cooperative activities. Under complex and dynamic conditions, informal structural mechanisms support formal structural integration [27].
- *Functional integration*: the system of IT decision-making and communication processes [28]. The decision-making processes and decision-making arrangements [29] are redefined in a later stage as "decision rights and accountability framework" [5]. The communication processes describe the formal communication and mutual adjustments among stakeholders [26], [27].

We define hard governance as the organizational aspects of governance, linking it to functional aspects like structure, process and the formal side of decision-making. These aspects are also defined as elements of organizational design. Structural integration mechanisms for ITG describe formal integration structures and staff-skill professionalization.

Soft governance

The third element *Social integration* is highly related to soft governance and related to people. People represent the most important assets of an organization. People do not work or think in terms of process and structure only; human behavior and organizational culture are equally important aspects of governance. Improvements are needed less in terms of structure and process and more in terms of the human or social aspects of governance [30]. Mettler and Rohner argue that an organization can be seen as a consciously coordinated social entity in which contextual factors describe the situativity in organizational design [31]. An understanding of the organizational culture is critical in a maturity model for ITG [32].

A survey by the IT Governance Institute showed that the culture of an organization was deemed by 50% of the participants as one of the factors that most influenced the implementation of ITG, surpassed only by "*business*

objectives or strategy", which scored 57% [18]. Thus, governance is about people too, which intimates that human behavior and social aspects are just as important. Soft governance requires greater attention.

2.2 ITG maturity

Most maturity models used for ITG are related to the existing frameworks previously mentioned, which are largely focused on processes and structure [32]. Thus in practice, processes and organizational structures are needed, but ITG has social elements, too. To be able to grow in maturity, organizations should pay attention to the hard and soft aspects of governance. Relational mechanisms can be seen as the social dimension [17] but are too limited to cover the broad range of topics from the social sciences which are relevant for ITG.

A systematic literature review searching ITG literature for maturity models that include the soft side resulted in five (relatively) new ITG maturity models [33]. Only two frameworks were found covering hard and soft ITG: COBIT 5.0 in a holistic way and the MIG model in a more practical way. The MIG model was developed using design science to measure hard and soft ITG [34] because an ITG maturity model covering both parts of governance did not exist [14], [18], [35]. In this study, we applied the MIG model and the corresponding MIG assessment instrument [14], [36].

The MIG model is a focus area maturity model (FAMM) designed to measure the hard and soft ITG of an organization. The MIG assessment instrument is an instrument designed to be used in practice to measure ITG maturity using the MIG model. The goal of this study is to evaluate the usability of the MIG assessment instrument, and in the process, to answer the following research question:

How usable is the MIG assessment instrument for measuring hard and soft ITG maturity in an organization?

FAMMs differ from previous approaches by defining a specific number of maturity levels for a set of *focus areas*, which embrace concrete capabilities to be developed, to achieve maturity in a targeted domain [37]. Table 1 summarizes the MIG model.

Table 1. The MIG model

Governance	**Domain**	**Focus area**	**Maturity model used**
Soft governance	Behavior	Continuous improvement	Bessant et al. [38]
	Behavior	Leadership	Collins [39]
	Collaboration	Participation	Magdaleno et al. [40]
	Collaboration	Understanding and trust	Reich and Benbasat [41]
Hard governance	Structure	Functions and roles	CMM [42]
	Structure	Formal networks	CMM [42]
	Process	IT decision-making	CMM [42]
	Process	Planning	CMM [42]
	Process	Monitoring	CMM [42]
Context	Internal	Culture	Quinn and Rohrbaugh [43]
	Internal	Informal organization	Using the nine focus areas of soft and hard governance.
	External	Sector	Sections of NACE Rev. 2 [44]

The MIG model follows the theoretical proposition that improving ITG focus areas will result in more mature ITG, which will result in improved firm performance. The context is important because research has shown that IT governance is situational and essential for delivering information about the situational part of ITG [18], [31], [32], [45].

We introduced two perspectives in the third version of the MIG assessment instrument: a departmental and a corporate perspective. To complement the instrument with a corporate perspective, we have been careful not to make significant alterations to the validated instrument [46].

Corporate governance is IT- and business-related. In practice there are almost no IT-specific projects: with the exception of some very particular technical projects, all projects are business-related. In the assessment, the participants were asked to fill out the questionnaire from both a departmental and corporate perspective. We explained that for "the entire organization", the focus area "IT decision-making" may be seen as "Decision-making". The statements were kept the same as in the previous version. The only change to the instrument was to double the questionnaires by adding a second column to the instrument for the corporate governance perspective.

The adjusted instrument consisted of three questionnaires:

- *Questionnaire 1*: containing 70 statements using a six-point Likert scale for the department and for the corporate perspective (the entire organization).
- *Questionnaire 2*: containing nine groups of two statements for the Informal organization. Respondents had to divide 100 points between each pair. Twice, again for the department and for the entire organization.
- *Questionnaire 3*: the third questionnaire on culture was based on an existing questionnaire, the Organizational Cultural Assessment Instrument (OCAI). The respondents filled out the questionnaire twice, once for each perspective.

During the interviews, we evaluated the results sheet for both perspectives. When processing the results, we created two results sheets rather than one. Each sheet displayed the maturity level reached for each of the nine focus areas, a table and a graph with percentages for "informal organization", and the positioning within the Competing Values Framework for one of the perspectives (see Figure 1).

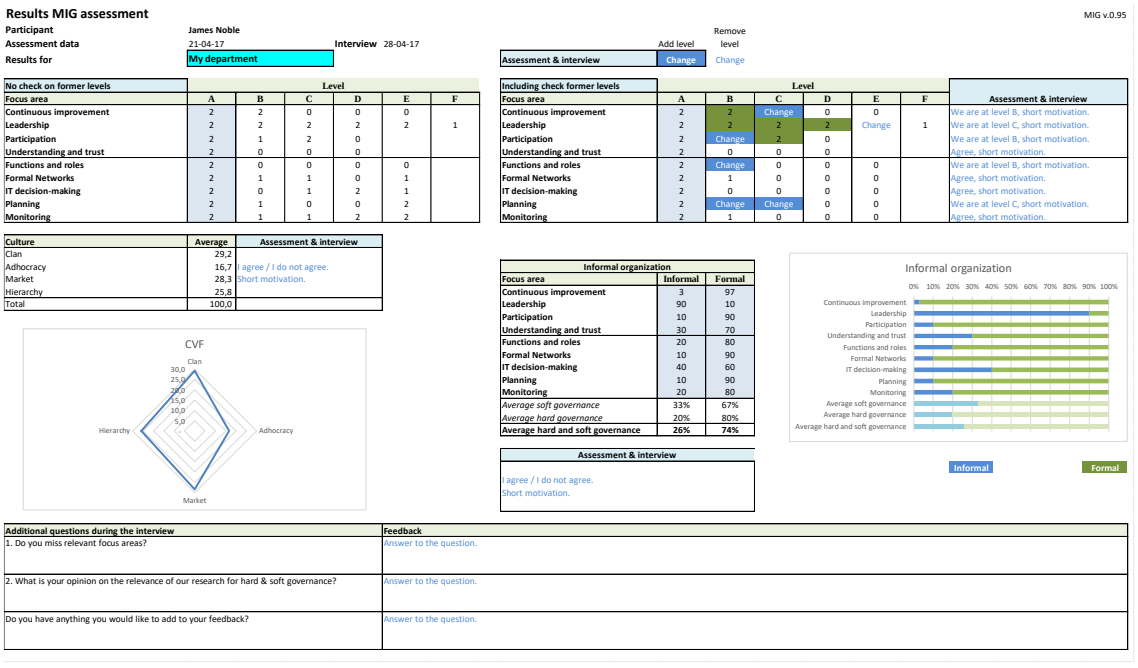

Figure 1. Example result sheet IG assessment instrument (department view)

The results sheet might appear more complex than the reality:

- The two upper tables show the results of the maturity part of the MIG model following the survey (left) and the interview (right). The tables show the maturity level reached for each focus area of the MIG model (questionnaire 1). Column A is the starting point. A colored box means that a level has been reached. The text "Change" means that the level was changed at the request of the interviewee.
- The graph and table on the lower right show the results of the points assigned to the "informal organization" for each focus area in the form of a graph and the associated data (questionnaire 2).
- The graph and table on the lower left show the results of the OCAI (questionnaire 3), consisting of the Competing Values Framework in the form of a graph and the associated data.

A description of the changes applied to the instrument during the third cycle are included in the results section. A full description of the MIG assessment instrument version 3 is included in Appendix C of the PhD dissertation "Hard and soft IT governance maturity" [47].

3. Research method

The research presented in this paper is based on design science. The MIG model and the MIG assessment instrument are also artefacts resulting from design-science.

Our research process was as follows:

a. Design the third version of the MIG assessment instrument based on an analysis of the evaluations of the previous version;
b. Conduct case studies using the third version of the MIG assessment instrument to test the usability for different types of users;
c. Evaluate the results of the study.

3.1 Design science

The scientific view of design originates from the concepts found in Simon's [48] seminal book *The Sciences of the Artificial*. Charles and Ray Eames [49] define design as "a plan for arranging elements in such a way as to best accomplish a particular purpose". Design science is "a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process" [50]. At its root it is a problem-solving paradigm. Design science is a science of the artificial that involves searching for the means by which artefacts help achieve goals in an environment [51]. The environment in this research is the organization. The goal of this study is to evaluate a designed artefact that can help the ITG of an organization to grow in maturity to become more effective.

There is no widely accepted definition of design-science research [52]. The design-science paradigm embraces seemingly contradictory principles [53]. Design and science share the same subject – in this study people and organizations – and produce artefacts, but their aims, methods and criteria are quite different [54]. Indeed, design is concerned with synthesis, whereas science is concerned with analysis [48]. This has resulted in a rich discussion around the process of design-science research, its artefacts and the role of theory.

In order to create a *useful* artefact to solve a practical problem, the design of the MIG model and instrument followed the guidelines of Hevner et al. [55] and Peffers et al.'s [56] design-science research methodology process model. In addition, we applied the guidelines and three cycles of Hevner: the Relevance cycle, the Design cycle and the Rigor cycle [57]. In the research, each cycle was covered:

1. The use of Delphi panels with practitioners to design the artefacts relevant for practice [58]. To be relevant in practice, the artefacts must be easy to use and understood in practice.
2. The design of the first version of the MIG assessment instrument was already published [34]. This paper describes the evaluation of the second and third version of the instrument. Evaluation is a key activity in design-

science research [59]. We collect information from the participants in the case studies to validate and evaluate the artefacts. "The actual success of a maturity model is proved if it brings about a discussion on improvement among the targeted audience" [60].

3. The studies are based on previous research and scientific methods when adding, combining or improving components of the artefacts.

Hevner et al. [55] note that the design-science paradigm seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artefacts. Design science is a commonly used approach in IS research as well in the social sciences [61]. Our goal is to design an ITG maturity model that can be used to help organizations to grow in maturity and thereby become more effective. This affects organizational processes, structures and the collaboration between people (the employees). Thus, we need to combine IS research and the social sciences.

Tarhan et al. [62] propose a distinction between the maturity model and assessment instrument because:

1. The model describes an improvement path while the instrument determines the status quo;
2. The instrument is not necessarily unique: there could be more assessment instruments based on the same maturity model e.g. an instrument for self-assessment and an instrument for use by (specialized) assessors;
3. The absence of a clear distinction may lead to flawed designs [63] and confusion [64].

In addition to the model, an assessment instrument was developed to determine the current status of an organization's ITG. The model was named the MIG model (Maturity IT Governance) and the instrument was named the MIG assessment instrument. The research approach combines knowledge from literature and experts from practice to achieve both "problem relevance" and "research rigor" [55]. The instrument is "necessary to determine how maturity measurement can occur" using the MIG model by "inclusion of appropriate questions and measures within this instrument" [65].

Empirically founded maturity models are rare [66]. Design science is well-suited to designing maturity models. The development of a maturity artefact should follow a design science approach as it gives a "methodological frame for creating and evaluating innovative IT artefacts" [55]. It is important to involve stakeholders throughout the process of design and thereafter [60], [65].

A maturity assessment instrument can be used to measure the current maturity level of a certain aspect of an organization in a meaningful way [67]. Maturity assessments are highly complex specialized tasks performed by competent assessors, rendering it an expensive and burdensome activity for organizations [67]. There is room for improvement by the provision of easy-to-use assessment guidelines [63]. It is important to test both the model and instrument [65].

Experts agree that design research involves designs that are clearly driven by underlying theories [51], in which theory and experience are engaged in generating new artefacts intended to change social and/or physical reality in purposeful ways. The goodness and efficacy of an artefact can be rigorously demonstrated via well-selected evaluation methods [55], [68]-[70].

3.2 Case studies and the case study protocol

The purpose of evaluation in design science is to determine if an instantiation of a designed artefact can "establish its utility and efficacy (or lack thereof) for achieving its stated purpose" [71]. As long as the instrument is in a development stage we combine the use of the instrument with semi-structured interviews. Interviews are often deemed an essential component of case study research [72]. Interviews seek to validate and evaluate [55] whether the results of the instrument correspond with the opinion of the participant and to gather information regarding the reasons why the participant does or does not agree with the resulting maturity level.

The assessment instrument was used in case studies conducted by students and by the researchers. The reasons for choosing this combination are threefold.

First, we incorporated triangulation by using different methods to collect data: participants were asked to fill out the assessment instrument, participants were interviewed using the results sheet, and the case studies were conducted by both Dutch and international full-time student-groups and researchers. By cross-validating the instrument when used by students and more experienced researchers, we expect to acquire a better understanding of the usability of the MIG assessment instrument in practice. The case study allowed students to bring topics together and support students to link and apply theory to practice [73], as well as develop useful insights regarding the complex workings and functional interactions of an organization [74], [75]. We adopted Willcocksen's unusual two-way flow of activity and research-based teaching to improve learning outcomes for students and research outcomes for academic staff [76].

Second, improving the research and education of Master's degree students registered for the IT management course at our university. This was a two-way process that "may be adapted to any discipline" and will lead to "both improved learning outcomes for students and improved research outcomes for academic staff" [76]. Studies on the nexus between teaching and research reveals that the variables used for teaching/learning quality or output and their operationalization are both diverse and limited [77]. Recent empirical evidence tends however to indicate a positive correlation between research performance and teaching [78]. Students were enabled – but not required – to use the MIG assessment instrument to assess a medium- or large-size organization (1000 FTE or more) in a practical group assignment. By summer 2018, none of the student groups had decided to use a different approach. If they chose to use the instrument, the students were required to follow the case study protocol. By engaging Master's degree students registered for the IT management course in ITG research, we complete an unusual two-way relationship, in which research underpins teaching and learning, and the teaching and learning activity underpins research.

Third, the designed artefact was intended for use in practice. The assumption was that if students are able to use the instrument, it can be expected that practitioners — who in general have much more practical experience — will also be able to use it.

For the application of the MIG assessment instrument, we used a case study protocol. The protocol is shown in Figure 2.

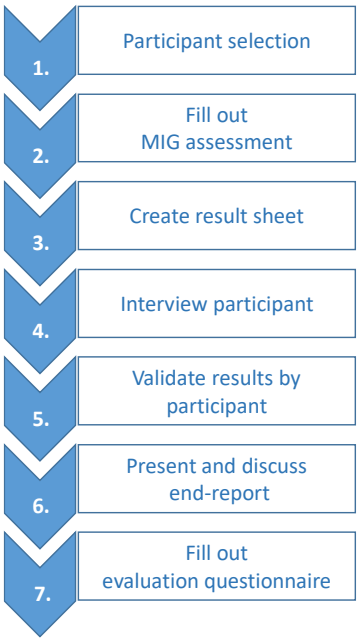

Figure 2. Case study protocol for the MIG assessment

The protocol used for the application of the instrument was as follows:

1. A group of participants in a strategic role from business and IT were selected and invited to participate in the study.
2. Each participant was asked to fill out the MIG instrument before the interview.
3. The researcher created the results sheet using the instrument and brought it as a handout to the interview.
4. During the semi-structured interview, the results for each focus area were discussed. Where relevant, the results were changed based on the opinion of the interviewee. The interviews lasted an average of one hour and were recorded.
5. Following the interviews, the results were summarized and sent to every participant for validation.
6. A report summarizing the results of the study were written, presented and discussed with the client and the participants.
7. The participants (for case studies conducted by the researchers) or students were invited to fill out a short evaluation questionnaire.

Having completed the interviews, the results were combined and analyzed. The results of the analysis, conclusions and recommendations were anonymized, summarized in a report and presented to the sponsor of the case study within the organization. The results of the case studies conducted by the students (cases 3–10) were also presented to the researchers. The student groups were obligated to share the completed customer versions of the MIG assessment instrument with the researchers. The evaluation form used was created based on an evaluation template for expert reviews of maturity models [79]. The participants were invited to fill out the evaluation questionnaire after the interview, while the students were invited following the presentation of the end results to the researchers.

3.3 Evaluation strategy

After each cycle the design of the MIG assessment instrument was evaluated and improved. During the design cycles a balance must be found in constructing and evaluating the evolving design artefact. Both activities must be convincingly based on relevance and rigor [80].

The first cycle started with the design of the first version of the MIG assessment instrument. Gregor and Jones' [81] anatomy of a design theory was used to evaluate the design of the MIG model and the MIG assessment instrument. Each year the instrument was changed only minimally. They state that a design theory that includes the first six components is sufficient to create a model of an artefact. Two additional components are needed to be able to implement the artefact in a practical instrument: principles of implementation; and an expository instantiation (= a physical implementation of the artefact). In Table 2 we describe how the design process complies with Gregor and Jones' eight components for the design of the MIG model and the MIG assessment instrument.

Table 2. Evaluation of the MIG model and the MIG assessment instrument based on Gregor and Jones [81]

Component	The way we complied with the component
1. Purpose and scope	The MIG model and the MIG assessment instrument intended to increase the effectiveness of the ITG of an organization by improving the maturity of the ITG focus areas.
2. Constructs	In the MIG model, ITG is represented by a set of relevant focus areas.
3. Principles of form and function	The MIG assessment instrument was created to assess an organization based on the MIG model. A case study protocol was described as a guideline for conducting case studies using the MIG assessment instrument.
4. Artefact mutability	The research was conducted in three cycles and demonstrated the mutability of the MIG model and the MIG assessment instrument.
5. Testable propositions	An element of the case study protocol was that the results of the MIG assessment instrument

Component	The way we complied with the component
	were discussed with a participant in an interview. The interviews intended to test if the results of the instrument corresponded with the opinion of the participant and to gather information regarding why the participant did or did not agree with the resulting maturity level.
6. Justificatory knowledge	The MIG model was designed using existing maturity models from the literature for each of the focus areas. The MIG assessment instrument was based on the MIG model and existing definitions of the maturity levels of each focus area.
Additional components	
7. Principles of implementation	The MIG model is a Focus Area Maturity Model (FAMM). An element of an FAMM is the definition of improvement actions for each focus area and each maturity level. These improvement actions are yet to be described but form part of the "Future research" section of this paper.
8. Expository instantiation	In several cycles case studies were conducted using the MIG model and the MIG assessment instrument.

The changes applied were the results of obvious inadequacies or improvements suggested by a substantial proportion of the participants. The intention is that the developed instrument will be used in case studies combined with semi-structured interviews. For the design cycle, the MIG model, the MIG instrument and the interviews of the case study are relevant.

In order to determine the validity of an instrument, "content validity", "construct validity", "reliability" and "internal validity" were to be evaluated (Straub, 1989). Given the qualitative nature of the research, we did not test for the relationship between variables ("statistical conclusion validity"). The purpose of evaluation in design science is to determine if an instantiation of a designed artefact can "establish its utility and efficacy (or lack thereof) for achieving its stated purpose" [71]. The semi-structured interviews were intended to validate and evaluate [55] whether the results of the instrument matched the opinions of the participants and to gather information regarding the reasons why they did or did not agree with the resulting maturity level. By using diverse data-gathering methods and comparing results, it became possible to determine the extent to which instrumentation affects the findings, as well as their robustness.

The results section covers:

a. The results of the evaluation and changes after the second cycle of the design process of the MIG assessment instrument (4.1);
b. The results of the case studies conducted with the third version of the MIG assessment instrument (4.2).

Thus, the focus of this study is the design and evaluation of the third version of the MIG assessment instrument. A full description of the MIG assessment instrument versions can be found in the PhD dissertation "Hard and soft IT governance maturity" [47].

4. Results

This section summarizes the changes to the MIG instrument after the second cycle and the results of the use of the third version of the MIG instrument. As explained in the previous section, during the third cycle the instrument was only changed minimally for obvious inadequacies or improvements suggested by a substantial part of the participants.

4.1 Evaluation of the second cycle

The changes in the third version of the MIG assessment instrument were based on the evaluation after the second cycle. The selected changes for the third version of the MIG assessment instrument are summarized in Table 3.

Table 3. Selected changes for the MIG assessment instrument after the second cycle

Top 5 suggested improvements	**Change?**	**Motivation**
1. Most of the questions are difficult to answer using just a "Yes"/"No" answer.	Yes	We introduced a six-point Likert scale representing 0, 20, 40, 60, 80 or 100% agree.
2. It is not clear to which organizational entity the question refers. An option would be to define two views, e.g. a single department and an entire organization.	Yes	We introduced two views as suggested: a view for a single department and a view for the entire organization.
3. The questions are too general.	No	We will not change the questions but improve the documentation of the instrument.
4. Some questions are too complex or unclear.	Yes	Improve the documentation of the instrument.
5. The results of the assessment and the interview are different. The interview should be leading.	No	We know this, hence we combined the assessments with the interviews.

For the third cycle in 2017 we introduced the following changes to the assessment instrument:

a. Participants using the previous versions delivered numerous comments about there being "too limited choice" where "Yes" and "No" are the only possible responses. The participants sought the ability to add some nuance to their answers. In 2017 the possible answers to the statements were changed from "Yes" and "No" into a six-point Likert scale using the following percentages: 0, 20%, 40%, 60%, 80% and 100%.

b. A second perspective was added, resulting in a departmental and organizational view (corporate governance view). Thus, in each of the three assessments, the participant was asked to answer the question from a departmental and an organizational perspective. A definition of both perspectives was handed to the participant to be used when filling out the assessment. As a result of this change, the assessment instrument created two results sheets, one for each view. This change was introduced because participants deemed it easier to answer the questions when they had the ability to compare their own department with other departments of the organization. In the case studies, the second view was always used as corporate perspective. An additional benefit of this second view was that it delivered data from a corporate (governance) perspective.

   An examples of the first three assessment statements for *Questionnaire 2 The informal organization* are displayed in Figure 3.

Assessment 2 - The informal organization

Please divide 100 points between columns D and F for each set of two statements (as shown in the example).

Focus Area	INFORMAL	My department Points		The complete organization Points		FORMAL	Remarks (optional)
Example	Our projects are nearly always successful.	70	30	60	40	Our projects have rarely been successful.	I think our department is more successful with projects. (This is only an example and not part of the assessment)
Informal organization	IT decision making is informally organized.					IT decision making is formally organized.	
	We use informal planning.					We use formal planning.	
	Monitoring is an informal process.					Monitoring is a formal process.	

Figure 3. Example of the statements for informal organization (simplified version)

c. Some questions are too complex or unclear. We improved the documentation of the instrument by adding an extensive list of definitions.

4.2 Results of the case studies during the third cycle

This section discusses the use and evaluation of the third version of the MIG assessment instrument. This third cycle of case studies is based on data collected in 10 case studies. All case studies were conducted in 2017 (see Table 4).

Table 4. Overview of the case studies

#	Sector	#P	Inf. (avg; σ)	Culture (1st)	Culture (2nd)	Size (x1000)
1	O; Public administration and defense; compulsory social security	10	58%; 11%	Hierarchy	Clan	57
2	O; Public administration and defense; compulsory social security	7	38%; 14%	Hierarchy	Clan	110
3	N; Administrative and support service activities	4	48%; 9%	Market	Hierarchy	5.5
4	P; Education	5	53%; 9%	Hierarchy	Clan	2.9
5	K; Financial and insurance activities	4	51%; 14%	Market	Hierarchy	54
6	M; Professional, scientific and technical activities	8	60%; 13%	Clan	Adhocracy	15
7	D; Electricity, gas, steam and air conditioning supply	5	46%; 10%	Clan	Hierarchy	64
8	I; Accommodation and food service activities	5	61%; 13%	Clan	Adhocracy	0.8
9	J; Information and communication	5	61%; 11%	Clan	Adhocracy	24
10	N; Administrative and support service activities	7	63%; 14%	Clan	Market	13

#	is the number of the case study in 2017.
Sector	is the sector of the organization, according to NACE v. 2 (section; description).
#P	is the number of participants in the case study.
Inf.	represents the average and standard deviation of the percentage informal governance between the answers of the participants.
Culture	shows the most dominant cultural perspective (1st = highest value) and second most dominant (2nd).
Size	is the number of employees in full-time equivalents (FTE).

All studies were conducted in organizations with more than 1000 employees. Eight were conducted by groups of four or five full-time students, and two case studies were conducted by the researchers (the cases #1 and #2). As an example, the first case study will be described in detail in this section.

During the preparation of the third cycle we used an evaluation form based on an evaluation template for expert reviews of maturity models [79]. The participants were invited to fill out the evaluation questionnaire following the interview, while the students were invited to complete it after presenting the end results to the researchers.

Detailed description of case #1: National government

This case study was conducted at a large independent administrative party of the Dutch government. A selection of 10 participants from business and IT were invited to participate in the case study. The participants were chosen in close collaboration with the responsible manager of one value chain of the organization. All participants had a management position (nine) or a key role (one) in the value chain, and were involved in strategic business and IT discussions with respect to the value chain.

Table 5 shows the results before and after the interviews for both views.

Table 5. Results of the hard and soft governance (before; after)

	Department view						The entire organization					
Governance/focus area	**A**	**B**	**C**	**D**	**E**	**F**	**A**	**B**	**C**	**D**	**E**	**F**
Soft governance												
Continuous improvement	10; 7	0; 2	0; 1				10; 7	0; 1	0; 1			
Leadership	6; 2	2; 4	2; 2	0; 2			8; 5	2; 3	0; 1	0; 1		
Participation	10; 2	0; 5	0; 3				10; 3	0; 6	0; 1			
Understanding and trust	10; 6	0; 4					10; 8	0; 2				
Hard governance												
Functions and roles	7; 4	1; 1	2; 5				6; 3	1; 2	3; 5			
Formal networks	8; 6		1; 3	0; 1			8; 6		2; 4			
IT decision-making	9; 8	0; 1	1; 1				8; 8	1; 1	1; 1			
Planning	7; 4	1; 2	1; 3		0; 1		7; 5		2; 4		1; 1	
Monitoring	7; 3	0; 3	1; 3		2; 1		7; 5	0; 1	1; 3		2; 1	

In general, there were considerable differences in the results, as demonstrated by the assessment and opinion of the participant regarding the soft governance part and relatively low number of changes to the hard governance part. Where participants suggested changes, they were always towards a higher maturity level in this case study. The participants thus always desired a change to a higher and never to a lower maturity level, compared to the maturity level displayed on the results sheet.

The rationale behind the changes provides some idea of the ways in which participants interpreted the focus areas. Some participants changed their opinion after an additional explanation of the focus areas, partly accounting for the changes.

Table 6 shows the results after the interviews for the focus areas of the context.

Table 6. Results of the context, view: value chain, after the interview

	Department view						The entire organization					
Governance/focus area	**Min.**	**Max.**	**Avg.**	**σ**	**Agree**	**Not agree**	**Min.**	**Max.**	**Avg.**	**σ**	**Agree**	**Not agree**
Culture												
Clan	25.0	48.0	35.8	7.3	9	1	16.7	43.3	28.2	9.1	10	0
Adhocracy	0.0	25.0	13.5	9.2	10	0	0.0	24.2	12.9	8.3	10	0
Market	0.0	24.2	13.4	8.9	10	0	0.0	28.3	15.1	9.7	10	0
Hierarchy	18.3	68.3	37.3	17.1	8	2	24.2	83.3	43.8	21.9	9	1
Informal organization												
Hard and soft governance	31%	57%	46%	9%	10	0	18%	58%	41%	11%	10	0

In the table, Min, Max, Avg. and σ are the minimum, maximum, average and standard deviation of the values/percentages between the participants' answers, respectively. "Agree" and "Not agree" highlight whether the participants agreed with the results of the assessment.

The participants mostly agreed with the results. There were two exceptions: a participant who responded that his score in the department view for "Hierarchy" was too high (31.7) and "Clan" too low (26.7) and a participant who responded that his scores for "Hierarchy" were too low (18.3; 24.2) in both views.

5. Discussion

5.1 Evaluation of the instrument

The case studies conducted by the researchers were in organizations one of the researchers knows very well. Thus, besides the results of the assessment and the interviews we already knew a lot about the strong and weak points of the organization. This was very useful for the evaluation of the instrument, when interpreting the results, deciding on the topics to go in depth during the interviews, and when assessing differences between the results of the assessments and the interviews.

In general, the comments regarding the use of the MIG instrument were positive: "The way of visualizing the results is very clear"; "The tool delivers very quickly an indicative impression of the maturity of several ITG processes". However, the comments on the statements and documentation were more critical: "Without the interview, the participant might misinterpret questions"; "To get reliable results, it is necessary to interview the participants".

Table 7. Overview of the suggested improvements during the case studies

#	Sector	#Participants	#Students	Improvements suggested:
1	O Public administration and defense; compulsory social security	10	0 (researchers)	2, 3, 5
2	O Public administration and defense; compulsory social security	7	0 (researchers)	2, 3, 5
3	N Administrative and support service activities	4	5	3, 4
4	P Education	5	4	1, 2, 5
5	K Financial and insurance activities	4	4	3, 4
6	M Professional, scientific and technical activities	8	5	3, 4
7	D Electricity, gas, steam and air conditioning supply	5	5	1, 2
8	I Accommodation and food service activities	5	5	1, 2
9	J Information and communication	5	4	2
10	N Administrative and support service activities	7	5	1, 2

#	is the number of the case study in 2017.
Sector	of the organization, according to NACE v. 2.
#Participants	is the number of participants in the case study.
#Students	is the number of students conducting the case study.
Improvements	are the top 5 suggested improvements for the MIG assessment: 1. The number of assessments is too low. 2. Equivocal, unclear or excessively black and white statements/questions. 3. Participants need further or better explanations of the semantics/terms used in the assessment. 4. Students would welcome a more detailed or standardized interview plan. 5. Basing the results simply on whether a participant agrees 80-100% is insufficient.

The case studies resulted in a long list of proposed improvements for the instrument, some important, some minor. These suggested improvements were analyzed and categorized. The top five most suggested improvements are included in Table 7.

5.2 Evaluation of the changes in the third cycle

The case studies of 2017 resulted in a list of suggested improvements (see the section 5.3). However, first we discuss the results of the changes applied in 2017.

During the third cycle we used the same criteria as in the previous cycle. Based on the feedback of the participants and the users of the instrument, we concluded that each change may be considered an improvement. Given that the evaluation of each amendment was positive (column *Keep* in Table 8), there was no reason to reverse any of the changes. Based on the feedback of the participants and the users of the instrument (the students), we can conclude that each change may be deemed an improvement.

Table 8. Evaluation of the changes in the third cycle

Changed during the third cycle	Discussion of the change	Improved?	Critique	Keep
1. Most of the questions are difficult to answer using just a "Yes"/"No" answer.	After changing the Yes/No scale into a six-point Likert, we did not receive any further comments. The only remark was that it would be preferable to have an option such as "Don't know". We did not add this option given the possibility of skipping questions and adding remarks.	Yes, fully resolved.	We received no critique regarding the change.	Yes
2. It is not clear to which organizational entity the question refers. An option would be to discern two views, e.g. a single department and the entire organization.	We added a definition of the views in the documentation. In some of the case studies, participants did not consider this sufficient. The description in the documentation might be retained but additional communication is required to clarify the part of the organization emphasized for the departmental view and corporate view.	Yes, fully resolved.	We received no critique regarding the change.	Yes
4. Some questions are too complex or unclear.	We supplemented the documentation but received the same comments on the questionnaire as in the second cycle. Some questions continued to be considered too unclear or general. Additional improvements to the documentation are thus required. An alternative option might be to alter the process by organizing a kickoff meeting with the participants of the study to explain the research and terminology used. In practice, organizing a meeting attended by all participants is very difficult and time-consuming.	Partly resolved.	We received no critique regarding the documentation (the change) but some questions remain. We need to further improve the documentation of the instrument.	Yes

Improved? Related comments decrease or stop completely.
Critique Critique regarding the change?
Keep Keep the change?

5.3 Evaluation of the results and preparation of the next cycle

Having completed the case study, the participants of case studies #1 and #2 as well as the students were invited to fill out a short evaluation questionnaire. The questionnaire used a six-point Likert scale ranging from "Disagree completely" (valued as one point) to "Agree completely" (valued as six points). The questionnaire was returned by eight participants in case #1 (80%) and six participants in case #2 (86%), as well as 20 students (56%).

Table 9. Summary of the evaluation

#	Statement	Case 1	Case 2	Students
10	The MIG instrument is useful for conducting assessments	4.3 (0.8)	4.7 (0.8)	4.4 (1.1)
11	The MIG instrument is useful for practice in my organization	4.3 (1.0)	4.5 (0.8)	3.9 (1.0)
12	The MIG instrument combined with interviews is useful for practice in my organization	4.9 (0.9)	5.2 (1.0)	5.1 (0.9)
17	The results of the MIG instrument can be used in practice in my organization	3.9 (1.1)	4.5 (1.0)	4.0 (1.1)
22	The results of the MIG instrument combined with interviews can be used in practice in my organization	4.6 (0.5)	5.2 (1.0)	5.0 (0.9)
33	Would you suggest any updates or improvements related to the MIG instrument?	N(7); Y(1)	N(6); Y(0)	N(2); Y(18)
37	Would you suggest any other updates or improvements related to the MIG model?	N(7); Y(1)	N(6); Y(0)	N(15); Y(6)

is the number of the statement on the evaluation form

The results for Case 1 and Case 2 in Table 9 are based on evaluations by the participants. The final column shows the results of the evaluation by the students. The comments for each case study have already been summarized in Table 7. The number in parentheses is the standard deviation. The participants and the students were generally rather positive about the usefulness and usability of the results of the instrument (in most cases being between 4 and 5 on a scale out of 6). Furthermore, the evaluation scores indicate that combining the instrument with interviews consistently results in higher scores. In general, the responses from the students during the practical examinations were positive, such as it was a "great learning experience for our team" (case #3).

6. Conclusion

This section summarizes the answers to the research question:

How usable is the MIG instrument for measuring current hard and soft ITG maturity in an organization?

The results sheets of the MIG assessment instrument are helpful during the structured interviews in discussing the focus areas. We received many positive comments on the usability of the tool in general: "The way of visualizing the results is very clear" and it "delivers very quickly an indicative impression of the maturity of several ITG processes". The case studies additionally resulted in a long list of proposed improvements to the instrument. Only two of the 10 case studies stimulated comments regarding the representation of the opinions of the participants in the results. Based on all comments concerning univocal statements, a higher percentage might be expected.

An evaluation survey among participants and students yielded positive results regarding the usefulness and usability of the results of the instrument (in most cases being between 4 and 5 on a scale of 6, see Table). Furthermore, the evaluation scores demonstrated that combining the instrument with interviews resulted in even higher scores (around 5). The results of the evaluation when asked to evaluate "the usability of the results of the MIG instrument in practice in my organization combined with interviews" resulted in scores between 4.6 and 5.2 on a scale out of 6. This accorded with the comments registered during the interviews with participants in the case studies conducted in the previous cycles. We thus conclude that the instrument is usable in practice for measuring hard and soft ITG. The interviews delivered valuable information regarding the reasons why the participants agreed or not with the resulting maturity levels, the graph of the Competing Values Framework, and the percentage for "Informal organization". This information can be used to improve the instrument. Substantial improvements to the instrument were applied during the design cycles. After the third cycle the top five most important improvements required were: (1) the number of assessments is too low, (2) equivocal, unclear or excessively black and white statements/questions, (3) participants need further or better explanations of the semantics/terms used in the assessment, (4) students would welcome a more

detailed or standardized interview plan, and (5) basing the results simply on whether a participant agrees 80-100% is insufficient.

The third version of the MIG assessment instrument is usable in practice, but further improvements are required to reduce the deviation between the results of the instrument and the opinions of the participants, as well as to fix certain deficiencies. We conclude that a combination of the MIG assessment instrument and structured interviews is useful for measuring current hard and soft ITG.

6.1 Limitations

The case studies described in this paper are conducted in the Netherlands and the in-depth case studies were in government organizations. The case studies show that it is possible to use the intrument to map the current ITG of an organization into the MIG model. The investigated organizations differ in terms of size and industrial sector. However, the evaluation was limited to organizations based in the Netherlands and large multinationals, which vary in size and industrial sector. Case studies in other countries or regions with different cultures might deliver different results.

6.2 Future research

The evaluation in this study indicate that the MIG instrument continues to require improvements, and this will require several cycles. We conducted case studies with relatively few participants (between three and 10). All cases studies described in this paper were conducted in the Netherlands. It would be interesting to conduct case studies with a larger number of participants or use and validate the model in other countries.

The MIG instrument was created in Excel. An online version of the instrument would be easier to use and represent a good way of creating a case study database that might be usable to create benchmarks. Further improvements to the questionnaire might help achieve the ultimate goal: to create an instrument that can be used by the members of an organization without requiring interviews to correct the results and render the instrument available to the public.

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Using a coach to improve team performance when the team uses a Kanban process methodology

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Abstract:
Teams are increasing their use of the Kanban process methodology across a range of information system projects, including software development and data science projects. While the use of Kanban is growing, little has been done to explore how to improve team performance for teams that use Kanban. One possibility is to introduce a Kanban Coach (KC). This work reports on exploring the use of a Kanban Coach, with respect to both how the coach could interact with the team as well as how the use of a coach impacts team results. Specifically, this paper reports on an experiment where teams either had, or did not have, a Kanban Coach. A quantitative and qualitative analysis of the data collected during the experiment found that introducing KC led to significant improvement of team performance. Coordination Theory and Shared Mental Models were then employed to provide an explanation as to why a KC leads to better project results. While this experiment was done within a data science project context, the results are likely applicable across a range of information system projects.

Keywords:
project management; process methodology; agile; team performance; Kanban; Kanban process methodology.

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1. Introduction

Kanban, a process methodology that focuses on visualizing the flow and minimizing work in progress, is becoming increasingly prevalent within the software development community [1]-[6] and it has been shown to have a positive impact on software development projects [7]. For example, at BBC Worldwide [8], the lead time to deliver software improved by 37%, the consistency of delivery rose by 47%, and defects reported by customers fell 24% as compared to the previously adopted agile method. Its value has also been noted in other information system contexts, such as when used within a data science context [9]. More generally, it has been noted that Kanban offers improved project visibility, quality, team motivation, communication and collaboration [2], [10].

However, a key challenge in achieving the benefit from the Kanban process methodology is ensuring that the team understands and appropriately follows the methodology. For example, within Microsoft, it has been noted that some team members did not fully understand the process, and hence did not understand that they were not following the process [11]. More generally, it has been noted that some of the key challenges when teams use the Kanban approach was that the teams lacked the specialized Kanban knowledge and training, and hence, that there was often a misunderstanding of the core Kanban principles [2], [12]-[16].

One way to address this challenge of lack of knowledge is to leverage the concept of a process coach, which helps ensure the team understands and follows the process methodology. The process coach is often used within the agile Scrum methodology, with the role known as the "Scrum Coach", which is a person who supports a team in achieving their specific goal by providing training, advice and guidance [17].

While research has shown the value of a Scrum Coach [18], the concept of a Kanban Coach (KC) has not been widely explored. While there are some new initiatives, programs and certifications on training Kanban Coaches [19], [20], there has not been significant research evaluating the effectiveness of KC, nor the appropriate scope of a KC. Hence, one potential area to explore, for teams using the Kanban methodology, is the role of a KC. Similar to a Scrum Coach, a Kanban Coach works to help ensure the team understands and follows the Kanban methodology (e.g., the number of work-in-progress tasks is not too high), and in general, supports and guides the team in their use of the Kanban process methodology.

It also should be noted that introducing a KC to a team using Kanban might not be positive. For example, there are no roles in Kanban [21], so it is possible that introducing a specific role could cause an issue and conflict with the general philosophy of the process methodology, in that adding a role to a process that does not have roles might make Kanban feel too process oriented or might suggest other roles, such as a team project manager that interacts with the KC. In addition, in terms of how the team interacts with the KC, it is not clear how the KC should interact with the team, since there are no required or well-defined meetings like there is in other agile techniques. Furthermore, the use of a KC might require extra work and/or costs that need to be justified. Finally, in terms of the scope of a KC, the role of a Kanban Coach might be different from the role of other coaches, such as a Scrum Coach, due to Kanban's focus on the Kanban board.

To help explore the potential value of a Kanban Coach (KC), this research focuses on the following research questions:

RQ1. Do team members embrace the role of a KC?

RQ2. Does the use of a KC improve team performance?

We explore these research questions via an empirical study evaluating the impact of a KC within the context of data science teams that used, or did not use, a KC. The use of Kanban within a data science context has been shown to be of value. For example, via a controlled experiment, Kanban was shown to have a significant improvement over other methodologies, such as Agile Scrum [9]. While the study focused on data science teams, the insight gained should be applicable to other information system focused projects.

The rest of the paper is organized as follows. First, some background context will be presented. Then our methodology is presented, which is followed by our findings. Finally, a synthesis of our observations will be provided within our discussion and conclusion.

2. Background

We first explore the benefits of coaching within an agile context. We then review the Kanban process methodology and finally, summarize current thoughts with respect to Kanban roles and Kanban coaches.

2.1 The benefits of agile coaching

It has been shown that coaching is an effective technique: in multiple studies undertaken, investigating whatever mode of coaching, the conclusion was the same – people like to be coached and perceive that it impacts positively upon their effectiveness [22].

The benefits of agile coaching have been well documented [23]-[24], and agile coaching has become a prominent practice in the agile world [25]. Agile coaching can bring many benefits including better understanding of agile practices [24], better teamwork [26], higher product quality, and lower overall project cost [27]. For example, it has been reported that teams migrating to Scrum without coaching support increased their productivity by 35 percent, while those with coach support recorded 300 percent or greater improvement [28].

We define a coach as a person who supports a team in achieving their specific goal by providing training, advice and guidance [17]. Coaching differs from mentoring, in that coaching focuses on specific tasks and objectives, as opposed to more general, longer terms objectives [29]. Note that this coaching advice is context and team specific, so a coach might provide different advice and guidance to two different teams, based on the team's collective background, knowledge and current challenges. The coach can play multiple roles including teacher, facilitator, coach-mentor, conflict navigator, collaboration conductor, and problem solver [24], and as noted previously, based on the challenges encountered by a team, the coach will provide specific advice for that specific team.

It has been noted that gaining the knowledge to use agile techniques cannot be acquired solely through reading books or attending lectures [30]-[37], but rather, these skills also need to be taught through practical exercises and coaching [30]. Hence, it is not surprising that the adoption of agile methodologies can be significantly facilitated by the use of agile coaching [38].

While there are several Agile Software Development (ASD) process methodologies, the most popular ASD for information systems development is Scrum [39]-[41]. Scrum was created nearly 20 years ago and is a software development process for small teams [42], [43]. When using Scrum, there is a defined Scrum coach role, where that person is responsible for guiding the team through their project, specifically through their iterative steps, with an aim of improving their agile practices [44]-[48]. The coach attends all the Scrum meetings, but does not solve technical challenges [49]. Instead, a Scrum coach discusses the various challenges with the team, and in general, helps the team to reflect on what to do next [17]. In short, the Scrum coach, working as adviser, can help the team adapt the methodology to their situation [28]. Scrum coaches are often used, and in fact, the Scrum Alliance even has a certification program for Scrum coaches [25].

Finally, with respect to data science, there is no commonly accepted agile coaching role. For example, when discussing agile data science, Jurney provides a list of data science roles but does not include a coach [50].

2.2 Reviewing the Kanban process methodology

Kanban is Japanese for "visual signal" or "card" [51], [52]. Starting in the 1940s, Toyota line-workers used Kanban (with physical cards) to improve their manufacturing process. The system's highly visual nature allowed teams to communicate more easily on what work needed to be done and when. The idea of Kanban is based on focusing on "work in progress", in that the approach aims to streamline the amount of work done at the moment.

Kanban is sometimes thought of as an agile process [53] and, at other times, as a way to execute lean principles. Based on a systematic mapping study [1], the most common definition of a Kanban methodology is the definition defined by Anderson [54, p. 6]: an "evolutionary change method that utilizes a Kanban pull system, visualization, and other tools to catalyze the introduction of Lean ideas… the process is evolutionary and incremental".

In the first academic study [52] about Kanban, three reasons for its use were proposed: reduction in information processing cost, rapid and precise acquisition of facts, and limiting surplus capacity of preceding shops or stages. More specifically, Kanban is based on three key principles:

- *Visualize the workflow* – Split the work into pieces; write each item on a "card" and put on the "wall" and using named columns to illustrate where each item is in the workflow. By creating a visual model of work and workflow, the team can observe the flow of work moving through its Kanban system. Making the work visible – leads to increased communication and collaboration.
- *Limit WIP* (work in progress) – Assign explicit limits to how many items may be in progress at each workflow state. By limiting how much unfinished work is in process, the team can reduce the time it takes for an item to travel through the Kanban system. The team can also avoid problems caused by task switching and reduce the need to constantly reprioritize items.
- *Focus on Flow* – By using work-in-process (WIP) limits and developing team-driven policies, the team can smooth the flow of work and make sure the team is focused on getting work completed.

Limiting the amount of work-in-progress (WIP), at each step in the process, prevents overproduction and reveals bottlenecks dynamically and is one of the key differences between a Kanban board and any other visual storyboards used within other methodologies.

2.3 Kanban roles and Kanban Coaching

Kanban does not prescribe any roles, rather, it requires the team to decide if there should be defined roles [55]. For example, Kanban recommends minimizing the cycle time, so if adding a role helps minimize the cycle time, the role can be added and if it makes the process slower, then the role should not be there [55]. Thus, a Kanban team can have a Kanban coach (a person who works as an adviser and can help the team leverage the methodology within their situation), or any other role, if that role is deemed useful for the team. Currently, as previously noted, there is not a lot of reported research on the value or even the use of a Kanban Coach [56]. However, it has been suggested that Kanban coaching can help to avoid failures with Kanban initiatives [57]. As suggested by Anderson [58], a KC could focus on discussing Kanban policies, visualization of the Kanban board, and metrics generated by the team. The role could help the team understand their capabilities and help them think about possible improvements [58]. Harzl [59] noted the presence of a Kanban coach, and it was rated very beneficial by all team members, but a clear definition of a KC and his/her responsibilities was not clearly defined.

2.4 Theoretical Background: Coordination Theory and Shared Mental Models (SMM)

In order to help understand why a Kanban Coach might improve the effectiveness of Kanban teams, we leverage Coordination Theory [60], in that we view that improved group work can be enabled via improved coordination between team members. In fact, it has been shown that improved coordination leads to benefits such as cost savings, shorter development cycles, and better-integrated products [61]. One way to improve team coordination, and thus, improve project work, is to have improved knowledge about dependencies between tasks and improved knowledge about tasks currently in progress. This follows other information system research that notes that teams will improve their performance by focusing on improving the team's collective understanding of the dependencies between the tasks that the different group members are performing [62], as well by improving the team's knowledge of what has been done so far [63], [64].

Coordination has been a long-standing interest of organizational scholars and computer scientists including [65]-[69] . One of the most common and concise definitions of coordination was proposed in [60] as "managing dependences between activities". Furthermore, it has been noted that there several factors that impact the success of Coordination

Theory adoption, including empirical, theoretical and social factors [70]. In short, the more complex the situation, the more coordination is necessary. Thus, Coordination Theory is a suitable tool to study how the coordination of team members will be changed after introducing Kanban Coach. This complexity might be due to a large number of actors/tasks or where temporality is factor [71].

In addition to Coordination Theory, Shared Mental Models are also leveraged for this research. Shared mental models (SMMs) can help enable teams to interact efficiently in the tracking of progress towards team goals [72]. In fact, empirical studies have shown that shared mental models are of substantial benefit to both team processes and performance [73]-[75] and researchers have become increasingly confident that one of the keys to team effectiveness lies with shared mental models within the team [75], [76]. This is due to the fact that if a team has improved team knowledge, which is shared knowledge across the team, then that team can better prioritize the work that needs to be done.

SMMs can be useful in improving team knowledge about dependencies between tasks and improved knowledge about the currently in progress tasks. An earlier study [61] noted two types of team knowledge: (a) shared knowledge of the task, and (b) shared knowledge of the team. A more recent model [77], expanded this view into four team knowledge categories, which are described as follows:

- *Task related knowledge* includes shared understanding about the content of the task, how the parts of the tasks interact, and how a task is connected to its environment. It also includes shared understanding about how a task is supposed to be accomplished by the team so that a sufficient level of performance can be achieved, and how task work is allocated to members.
- *Team-related knowledge* includes team members' knowledge, skills, attitudes, preferences, and tendencies. It also includes shared knowledge of where expertise is located and where it is needed.
- *Process-related knowledge* includes shared understanding of team processes such as communication, leadership and coordination. It also includes shared expectations of how to behave (norms) and useful patterns of action.
- *Goal-related knowledge* includes shared understanding of the goals, visions, and overall agreements pertaining to the team's work. Such goals are mental representations of the overall goal or mission for the team, its performance objectives, and also strategic goals for the organization.

Thus, taken together, we hypothesize that a KC can improve the coordination of a team via the use of SMMs.

3. Methodology

To evaluate the impact of a Kanban Coach on a Kanban team, a controlled experiment was conducted within a graduate level Introduction to Applied Data Science course, where teams that had a KC were compared to those that did not have an assigned KC. The aim of the study was to understand if a KC was helpful for the team. Specifically, during a 10 week student project, teams of 5 to 7 students analyzed a realistic, but not real, dataset of customer survey responses, within the context of a global hotel chain. Even though this was a student project, the project was designed as realistic as possible, which is a best practice when using students to understand how teams work in industry [9], [36], [78]. In this course, the students acted as consultants, with the class instructor acting as the client. The goal for each team was to obtain valuable actionable insights from the data analysis and present those results to their client.

The dataset contained approximately three million responses and each response contained information about the person who responded to the survey (ex. place of residence, a member of their rewards program, and if so, what level), information about the hotel (ex. location) and information about the responses to the survey from the customer who stayed at the hotel (ex. would they recommend the hotel to a friend). The goal of the project was to utilize data mining techniques to predict guest return probability through identification of key drivers/factors that could improve customer satisfaction (ex. room tranquility or customer service).

3.1 Experimental conditions

The students were randomly assigned to teams for the project. Each team was then randomly assigned to either have, or not have a KC. Specifically, students were randomly assigned a class section. The team members for a project were all from the same section and all the teams in the section either had a Kanban Coach (the "KC" condition), or did not have a Kanban Coach (the "noKC" condition).

Across both conditions, at the beginning of the semester, the Kanban methodology was introduced and explained to the teams (almost all students had no previous experience with Kanban). Specifically, all team members were provided training on how to use the Kanban process including the overall Kanban methodology and the key points of focus when using Kanban (e.g., limit work in progress, visualize the flow). In addition, the online Kanban board (trello – a web-based Kanban board) was demonstrated and it was explained what kinds of tasks were expected to be placed on the board. As per the typical Kanban process, the teams were instructed to work through their project pipeline throughout the project with no defined schedule. The goal was to make sure that there was not a lot of time spent on an effort that was not completed (it was better to get a fewer number of tasks all the way through the pipeline). It was required, across both conditions, that the teams use the online Kanban tool and that they keep their Kanban board up-to-date and hold at least weekly team meetings. Time for questions with respect to how to use Kanban was provided for all teams, and throughout the semester, if students had additional questions, they were able to reach out to a TA for the class (who had knowledge of the Kanban process).

In addition, for teams in the KC condition, a Kanban Coach was assigned to each team (one KC covered more than one team), and those teams were provided with a clear process of how to work with their KC. The KC was a TA for the class who had knowledge and experience using Kanban. To facilitate the discussion between the team and the KC, teams in the KC condition were required to use a special first column on their Kanban Board, labeled "proposed". Specifically, the teams put suggested tasks in the "proposed" column, and the KC would then move those tasks to the "to do" column (i.e., the next column on the board). Only the KC moved tasks from "proposed" to the "to do" column. This helped to provide a structure such that the team could easily get feedback from the KC, and the team (and the KC) could ensure that the task was appropriate and well defined. Then, as with teams in both conditions, when someone was ready to work on the task, that task would then be moved from the "to do" column to the next appropriate column. The Kanban Coach mainly interacted with the team via the Kanban board, typically once or twice a week. More generally, the KC focused on:

- Providing feedback via the board (ex. the moving tasks from the "proposed" column);
- Making sure a team used an appropriate level of granularity for the tasks (ex. not too broad or too specific tasks);
- Reviewing progress since last update (via reviewing the movement of the tasks on the board);
- Encouraging the team to make sure the Kanban board is up-to-date.

In summary, teams in the KC condition had a structured communication mechanism to communicate with the KC, via the "proposed" column.

3.2 Data collection

To evaluate the impact of the KC, we compared the effectiveness of the teams that had a KC to the teams that did not receive the coaching (i.e., the noKC teams). Following a case study best practice from Eisenhardt [79], multiple data sources were used. We focused on qualitative data (from the instructors and the students) as well as quantitative data (board quality, progress on the board, as well as the final project quality). We discuss each of these in more detail below.

First, in terms of the quantitative data, an evaluation of the Kanban boards generated during the project provided a leading indicator with respect to the quality of the project. Specifically, there were three evaluations of the boards during the project. The first evaluation was three weeks after the project started, the second evaluation was one month later, and the last evaluation was two weeks before the end of semester.

The boards were evaluated according to the following criteria, with each criterion being scored on a scale of 0 to 5:

- *Board Quality* - this metric was calculated by examining key aspects of the board, such as whether teams were minimizing their work-in-progress, if there enough tasks on the board to keep the team busy and if the tasks were described in a reasonable manner.
- *Board Progress* – this metric captured the amount of progress, as shown on the board, that the team had made from the previous update (i.e., were there enough tasks being created and "moving through the pipeline").

In addition, a *final project evaluation* was also performed, with a score ranging from 0 to 20. The final project evaluation criteria were not focused on the use of Kanban, but rather, the quality of the overall analysis. So, for example, a key aspect of the grading rubric included the quality of the actionable insight generated. The Kanban board evaluation was conducted by two annotators and the final project was evaluated by three independent reviewers. For these evaluations, there was a high degree of agreement between the reviewers and any differences of opinion were identified, discussed and resolved.

In terms of qualitative data, *instructor observations* provided insight into how effectively the teams were working together, as well as the group dynamics within the team. For example, during each lab session, the instructor observed the student teams and documented and reflected on those observations via answering semi-structured questions. The observations focused on the perceived satisfaction, productivity and cohesiveness of the team members. In addition, at the end of each semester, a semi-structured *student survey* was distributed to each student to explore their perceptions with respect to the methodology that they used. The key question to the students was a neutral stimulus: "What were the advantages / disadvantages of using the Agile Kanban process methodology?" Students in the KC condition were also asked about their use of the proposed column and their interaction with their KC. The qualitative data was analyzed via an iterative process of item surfacing, refinement and regrouping.

4. Findings

331 students participated in the study across 59 teams. Of those 331 students, 206 were in the KC condition (in 39 of the 59 teams studied) and 125 in noKC condition (in 20 teams). Thus, the average team size was 5.3 in the KC condition, and 6.3 in the noKC condition. Across both conditions, the students had a diverse set of undergraduate degrees, ranging from chemical engineering to business. The students also had diverse geographic/cultural backgrounds, with students gaining their undergraduate degree from Asia, Europe and North America. In fact, while all the students attended the course in a face-to-face format in North America, the majority of students had previously been educated outside of the United States. In addition, forty percent of the students were female. Finally, the majority of the students had two to five years of work experience, typically within the IT industry, thus supporting the notion that these graduate students were a good proxy for junior level staff within a corporate context.

4.1 Board and project evaluation

The impact of a KC on the quality of the Kanban boards and the progress each team made (via an analysis of the progress of their Kanban board) was evaluated using independent sample t-tests, the results of which are shown in Table 1. Specifically, there was a significant difference in the board quality with a KC ($M=4.84$, $SD=0.3$) and with no KC ($M=4.2$, $SD=1.07$) conditions; $t(20)=2.6$, $p = 0.008$. In addition, there was a significant difference in the board progress with a KC ($M=4.14$, $SD=0.79$) and with no KC ($M=3.48$, $SD=0.86$) conditions; $t(36)=2.85$, $p = 0.004$. Furthermore, there was also a significant difference in the final project evaluation with a KC ($M=18.25$, $SD=1.6$) and with no KC ($M=16.43$, $SD=2.0$) conditions; $t(57)=3.78$, $p = 0.0002$.

This shows that introducing the KC role helped to improve the teams' overall performance as well improve the leading indicators of team performance (board quality and progress).

Table 1. Comparing KC vs noKC using an independent sample t-test

Statistic	**Board Quality (KC / noKC)**	**Board Progress (KC / noKC)**	**Final Project Evaluation (KC / noKC)**
Means	4.84 / 4.2 (5 is highest score)	4.14 / 3.48 (5 is highest score)	18.25 / 16.43 (20 is highest score)
Variances	0.09 / 1.15	0.62 / 0.73	2.58 / 4
Standard Deviation	0.3 / 1.07	0.79 / 0.86	1.6 / 2
Observations	39 / 20	39 / 20	39 / 20
Hypothesized Mean Difference	0	0	0
df	20	36	57
t Stat	2.6	2.85	3.78
P(T<=t) one-tail	0.008	0.004	0.0002

4.2 Perceived differences across the conditions

In analyzing student comments and the instructor observations, three key themes emerged for teams that had access to a Kanban Coach as compared to those teams that did not have access to a Kanban Coach (systematizing work, clarity of objectives, required time). We discuss each of these below, integrating comments from students with the instructor observations.

Improved Ability to Track Progress: People in KC condition much more often reported that the Kanban methodology helped them systemize their work and structure their knowledge. For example, one student noted that "It helped to keep a track of progress, and move [us] ahead with the project in a systematic manner", another noted that "This process kept everything organized" and yet a different student commented that "It's easy to organize new tasks as well as add notes when we are doing discussions". Finally, yet a different student noted that "[it] helped to keep a track of the activities to be performed and so, in a way, helped in planning during the project". This was re-enforced by the instructor observations, such as one instructor that noted "the teams seemed much more organized when they had access to a KC".

Clarity of Objectives: Multiple teams in KC condition noted that the methodology helped to make the project objectives clearer. For example, one student commented that "we have a clear understanding of what were our research objectives and what activities we needed to perform to reach that objectives", and another stated that "it [the process when using a KC] made us segment our work, have clear objectives and coordinate team effort". This clarity of objectives might have been driven by the fact that the instructors perceived that the students in the KC condition both understood and followed the process better, as suggested by one instructor who noted that "the more focused feedback [by the KC] encouraged the students to be more focused on ensuring that they adhered to the process methodology".

Improved Efficiency in using Kanban: It is interesting to note that only the noKC teams stated that they thought that their methodology was time consuming. This included comments by students in the noNC condition such as "[it was] time consuming to update and maintain [the Kanban Board]". This suggests that the KC helped the teams be more efficient in the use of the Kanban process and also helped the team understand the value of the process (and thus, they thought the time discussing the Kanban board, for example, was time well spent). This was perhaps due to some noKC teams using Kanban as a way to communicate to the instructors, as explained by one instructor "some of the teams in the noKC condition sometimes seemed to use the Kanban process as a reporting mechanism to me, rather than using Kanban as a project management process that I could observe".

4.3 Perceived similarities across the two conditions

There were also three themes (project efficiency, clear responsibilities, team collaboration) that were noted across both conditions, below we review these themes.

Project Efficiency: Many students noted a perceived increase in team efficiency. For example, one student in the KC condition noted that the "main advantage of this process is saving of time and it also helps us to improve our efficiency". Other students also noted that Kanban improved efficiency, such as a student (in the KC condition) who stated that "[it] also made it easy to manage the class project and proved very helpful in improving the overall productivity and work efficiency" and, by a student in the noKC condition who stated that "Kanban offers a systematic approach to identifying opportunities for improving efficiency".

Clear Responsibilities: Some students stated that they liked their process methodology because it provided a clear view of who is contributing in the team, such as a student in the noKC condition who stated that "…it also holds accountability among group members". Students also felt that it became more clear who was responsible for each task, such as a student in the noKC condition who noted that it "allows us to track which individual is responsible for which task" (noKC) as well as from a student in the KC condition who reported a similar thought via their comment of "it's very important to track the progress of the project life cycle and for keeping team aware of the tasks and responsibilities".

Team Collaboration: The ability for the team to collaborate was highlighted by both conditions, but was noted more frequently by teams that had access to a KC. For example, a student in the KC condition noted that Kanban has "flexibility and [makes it] easy to collaborate". Other similar comments included that "collaboration between team members was easy" by a student in the KC condition, and via a student in the noKC condition, who noted that "I think this project management… can boost the efficiency and communication within a group".

5. Discussion and Conclusion

Qualitative student feedback, reviewed in Section 4.2, makes it clear that team members embraced the concept of a KC. Furthermore, the quantitative analysis, in Section 4.1, shows that introducing the KC improved the teams' overall performance as well improved the leading indicators of team performance (board quality and progress).

To explore why the KC was useful to the Kanban teams, we leverage coordination theory and shared mental models, which were described in Section 3 and provides a foundation to help understand the impact of a Kanban Coach. Specifically, leveraging coordination theory and SMMs, a Kanban Coach was helpful because the KC helped to improve the team's coordination via an improved shared mental model of process related knowledge (i.e., knowledge of the Kanban process) as well as the team's task-related knowledge (i.e., knowledge of the tasks the team were actually doing). This improved task-related related knowledge is a result of the team's more effective use of the Kanban process, which provides a visual view of the work in progress. The model in figure 1 explains how a KC improves project outcomes.

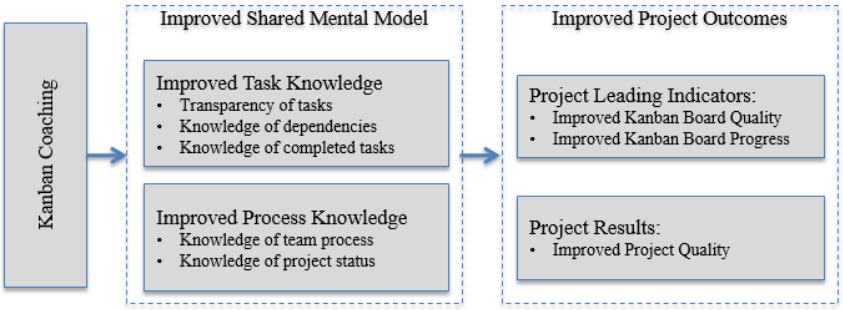

Fig. 1. Model explaining how a KC improves project outcomes

Thus, as shown in Figure 1, a Kanban Coach helps a team improve their project outcome by creating an improved shared mental model of task and process knowledge. In short, the team's coordination improved via improved knowledge of what tasks are in progress, done and need to be done.

5.1 Reliability and Threats to Validity

There are several threats to the validity with respect to our results. First, some teams might consider having a new aspect to the methodology as being helpful, independent of that enhancement's actual value [80]. To help mitigate this potential issue, the students did not know if having access to a KC was a new capability within the methodology. Furthermore, students did not get specific credit for correctly using "proposed" column.

With respect to selection bias (participants might have been selected who have certain characteristics that predispose them to have certain outcomes), this potential bias was eliminated due to the fact that the class was randomly split into teams, and teams were randomly selected to have, or not have, a Kanban Coach.

An external threat to validity is the generalizability of our findings (e.g., generalizing the in-class experiment to an industry context), such as when a researcher generalizes beyond the groups in the experiment to other groups not under study, or to settings not studied [80]. In fact, the generalization of student results to industry has been often questioned [81]-[84]. One key issue, with respect to generalizing student results to industry is that sometimes in-class tasks are not representative of typical industry tasks, and therefore, the results of an in-class experiment might not transferable to industry [83]. However, this research had students work on a 10-week project that was representative of tasks that one would do within an industry context. Furthermore, it has been noted that classifying experimental subjects (students) by their status (experience or being a student or worker) is a proxy for a more important and meaningful classification, specifically classifying the subjects according to their abilities, and effort should be invested in defining and using these more meaningful classifications [85]. This research leveraged graduate level students with an average of three years IT experience. Thus, while using students as subjects is threat to validity, we view these subjects as a reasonable proxy for junior level employees.

Finally, this study focused on a data science project, and hence, it is possible that generalizing to other domains, such as software development might not be appropriate.

5.2 Potential Next Steps

Even though previous research has noted that students are a good proxy for junior team members and can be viewed as the next generation of professionals, and hence, are suitable subjects for information systems experiments [84], since this experiment was conducted within an academic setting, it is possible that the results might be different within an industry setting and thus one next step is to evaluate the impact of a KC within an industry project.

In addition, as previously noted, it is not clear if the results from this experiment, which focused on a data science project, are applicable to other domains. In other words, it is possible that other projects, such as software development, might yield different results. So, another next step is to explore the benefit of a KC within other project contexts, such as software development. Yet different avenue to explore could be that, rather than using a Kanban Coach, one could consider the use of a Kanban Master (KM). In contrast to the KC, a KM would attend all the teams' meetings and would be thought of as a key member of the team, not an advisor to the team.

Furthermore, Design Thinking, which is generally defined as an analytic and creative process that engages a person in opportunities to experiment, create and prototype models, gather feedback, and redesign [86], could be an interesting avenue to explore. For example, agile methodologies such as Kanban can be viewed from Design Thinking perspective. Thus, exploring how to improve Kanban via a Design Thinking framework might provide new ideas and insights, since this approach has recently applied to agile methodologies [87].

Finally, in this study, a proposed column was used as a way to facilitate communication between the KC and the team. A future area of research could explore other mechanisms to facilitate/improve the communication between the KC and the team, as well as how the proposed column itself could play a role in improving the teams' performance, independent

of a KC. For example, one avenue to explore is if the proposed column could be used even without KC to improve the team's internal communication with respect to collectively deciding on which tasks are appropriate to be prioritized by the team.

5.3 Conclusion

While the use of a coach has proven to be useful in many contexts, including agile scrum, to date, there has been minimal research exploring the effectiveness of a coach within a Kanban context. This paper addresses that gap by investigating the impact of a coach within data science teams that use Kanban.

To address our first research question (*do team members embrace the role of a KC*), we evaluated qualitative team member feedback for the students that had access to a KC. The feedback suggests that the teams did indeed embrace a KC, in that the team members thought that the KC helped them improve their collective ability to track progress, ensure there is a clarity of objectives, and be more efficient in the use of the Kanban process. This suggests that the team members (students) did perceive their interactions with the KC as being helpful. To address our second research question (*does the use of a KC improve team performance*), a quantitative analysis was conducted across the two conditions (teams with, and without, a KC) and it was found that introducing a KC did indeed lead to an improvement of the team performance (grades) and as well as a leading indicator of project performance (i.e., board quality).

This research makes several contributions to the field. First, the coaching role was introduced within a Kanban context. In particular, a definition of KC was provided and the responsibilities of a KC were explained. Second, the use of the proposed column, which defines a paradigm specific to Kanban for establishing a structured way for teams to communicate with the Kanban Coach, was defined. Third, an in-class experiment demonstrated that the KC role was indeed helpful. Fourth, coordination theory and shared mental models were leveraged as a theoretical foundation to help explain why the KC was helpful. Finally, this research also provides some additional context on why Kanban is useful, as some key themes (such as improved collaboration) were noted across teams that had the KC as well as teams that did not have access to the KC.

Thus, there are both theoretical and managerial implications of this research. From a theoretical perspective, this research demonstrates how coordination theory and can be integrated with Shared Mental Models to provide a theoretical foundation to explore how process refinements can improve team outcomes. From a manager's perspective, this research suggests that organizations should use a Kanban Coach for their Kanban-based projects.

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