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The Impact of Project Management Tools on Project Results: Evaluation of a Survey Among Managers Leading International Development Projects for four selected Central and Eastern European Donors

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Abstract: As the success rate of international development projects might be still below expectations, several studies have explored whether and how the use of project management (PM) tools might improve internal and external project performance. This article looks specifically at four selected Central and Eastern European countries and evaluates a newly collected data set. Based on a survey, the study examines the adoption of PM tools among project managers in the region. Furthermore, with the use of cluster analysis, it suggests that the tools are adopted progressively in four stages that differ culturally from other international studies. Last but not least, using structural equation modelling, the research indicates that among the surveyed project managers, the use of stage 1 tools might directly contribute to the improvement of internal project results and that these internal results might then have a positive impact also on the external project performance.

Keywords: international development, project management tools, project performance, Central and Eastern European donors, cluster analysis, structural equation modelling

JEL Classification: O22, F35, F36

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Introduction

Since its establishment, official development assistance (ODA) has become a crucial means for development in many poor countries and regions as these cannot often generate domestic savings needed to initiate sustainable growth (Odoom et al., 2021, Parsad and Inaba, 2021, Zuofa and Ochieng, 2014). Bilateral and multilateral donors, global and regional development banks, local governments, public and increasingly also private firms and philanthropes thus finance international development (ID) projects (Bashir et al., 2021, Boakye and Liu, 2017, Burns, 2019) in order to contribute to poverty reduction, improvement of the livelihood of local communities, enhancement of technologies, environmental sustainability etc. (Boakye and Liu, 2017, Ika et al., 2020, Saleh and Karia,

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2020). ID projects therefore form a heterogenous group targeting all sectors of the economy: they can focus on "soft" objectives such as education, human rights or gender equality (Ika et al., 2020) or on "hard" sectors such as construction, telecommunication, agriculture, waste disposal, power generation and distribution etc. (Boakye and Liu, 2017, Ansah et al., 2021, Zuofa and Ochieng, 2014, Ika et al 2020). With the advancements in technology, ID projects also more and more concentrate on e-governance, data collection, analysis and management, artificial intelligence and other technology areas (Miković et al., 2020, Duffield, 2013, Madianou, 2019).

However, despite the essential role they might play in development, ID projects often turn out to perform badly (Boakye and Liu, 2017, Bashir et al., 2021). Literature (e.g., Rodríguez-Rivero et al., 2021, Gbahabo and Ajuwon, 2017, Ahsan and Gunawan, 2010, Shafiei and Puttanna, 2021 etc.) indicates various failure rates depending on regions, donors, and sectors, but the share of failed ID projects usually reaches above 50% (Ika and Munro, 2022), making unsuccessful completion rather a rule than an exception (Hermano et al., 2013).

Due to the high diversity of the ID sector, each project is unique, and it is thus impossible to define clear one-size-fits-all criteria for project success or failure (Dick-Sagoe et al., 2023, Zuofa and Ochieng, 2014, Damoah et al., 2015). Traditionally, the success of a project was determined by its internal performance, i.e., by the result of the three Iron Triangle components: the completion of the project within its planned budget, schedule and with the defined scope (Dick-Sagoe et al., 2023, Damoah et al., 2015, Daniel and Ibrahim, 2019, Ikechukwu and Ozuzu, 2021, Zuofa and Ochieng, 2014). However, the current evaluation approach takes into account the external performance of the project as an ID project might perform perfectly well in terms of its budget, schedule and scope but still end up as a complete failure because it did not deliver the anticipated long-term impact and benefits to the aid-receivers (Boakye and Liu, 2017, Eja and Ramegowda, 2020, Zuofa and Ochieng, 2014).). There is no conclusive list of the external evaluation criteria to monitor as these are highly dependent on the project goals and scope. Nevertheless, literature suggests several general measures to consider, such as the contribution to the sector and national development in the aid-receiving country (Damoah et al., 2015), economic sustainability after the project end (Golini et al., 2015), stakeholder involvement and satisfaction (Golini et al., 2015, Dick-Sagoe et al., 2023, Daniel and Ibrahim, 2019, Zuofa and Ochieng, 2014, Nzekwe et al., 2015), achievement of minimum return of investment (Dick-Sagoe et al., 2023) and other.

To improve the delivery of ID projects, literature (Ahsan and Gunawan, 2010, Gbahabo and Ajuwon, 2017, Shafiei and Puttanna, 2021, Boakye and Liu, 2016, Eja and Ramegowda, 2020, Nzekwe et al., 2015) has investigated common pitfalls that may cause ID projects to fail both internally and externally. The research indicates corruption, poor project design and planning, insufficient monitoring, bureaucracy, procurement issues, unrealistic time and cost estimation, lack of supervision, political reasons or poor project management as the main underlying reasons behind project failures.

This article looks deeper into the last-mentioned cause – the project management (PM) area. Quite a thorough research (Golini et al., 2015, Montes-Guerra et al., 2015, Czahajda, 2019, Keleckaite, 2015, Matos, 2019) has already been conducted in the international development industry in order to examine what project management approaches are

adopted on the ID projects by specific cultures and internationally and how these approaches influence the project results. However, these studies focused primarily on project managers from the non-profit (NGO) and public sectors, leaving private-sector managers out of scope. The international development context has changed in recent years, though, as donors more and more encourage for-profit firms to engage in development activities (Scott-Smith, 2016, Darko, 2014, ONGD, 2021, Madianou, 2019, Pascucci, 2021).

The entry of the new for-profit actors and their influence on the ID sector in terms of project management is, however, not reflected in the existing literature. This article therefore aims to bridge this gap and includes also private organisations that lead ID projects as a single-sector delivery or in co-operation with traditional non-profit and public actors. It looks specifically at the delivery of ID projects funded by four Central and Eastern European (CEE) donors, namely the Czech Republic, Hungary, Poland and Slovakia that have – with the exception of Poland – stayed outside the main focus of the project-management-related research as their aid flows are still relatively small. Slovakia was the 3rd smallest OECD donor in 2022 in terms of US dollars provided for aid, Hungary the 6th smallest and the Czech Republic the 10th smallest donor (OECD, 2023a). Although some of the existing findings from other cultures and from the international level might be generalised and used as a rough project management guidance for the CEE donor agencies and their implementing organisations, they cannot be taken as a norm as the PM practices often vary geographically and culturally (Rodríguez-Rivero et al., 2019).

To reflect the research gaps described above, this article has three goals. Firstly, it aims to explore what project management tools are applied by the project managers from all sectors leading ID projects funded by the four CEE donors. Secondly, it aims to analyse how the project managers adopt these tools based on their project management maturity, and thirdly, the article aims to establish how the PM tools used on individual project management maturity levels influence the internal and external project performance. As a result, the article aims to provide guidance to the donor agencies as of what to require from their implementing organisations in order to increase the chance of project success. To do so, the paper analyses a new set of survey data collected among the project managers leading the CEE-funded ID projects.

The rest of the article is structured as follows: the first chapter explores the findings of the existing research on the adoption of PM tools in the ID industry and their impact on project outcomes. The second chapter describes the conducted survey, collected data, and used methods, while the following chapter includes and comments on the results while taking into consideration the findings of the existing literature. The article closes with a short conclusion and a policy implication.

Project Management Tools and Their Impact on Project Success

Project management methodologies can be defined as a set of various tools, templates, best practices, methods, processes and attitudes (Keleckaite, 2015, PM4DEV, 2014) that are used by project managers and teams in order to increase the chance of project success (Pace, 2019, Lazima a Coyle, 2019). A number of general and sector-specific methodologies, such as PRINCE2, PMBOK, Agile, Waterfall etc. have been developed for the private sector (Matos, 2019, Golini et al., 2015), however, these mainstream approaches

rarely consider international development projects due to their specific nature (Ika et al., 2020, Matos, 2019, Ahsan and Gunawan 2010, Khang and Moe, 2008).

The new millennium has therefore seen the creation of several new ID-specific project management methodologies. Firstly, independent professional bodies have customised the standard PMBOK approach to better reflect the challenges of the international development industry and created standard ID-specific project methodologies, namely PM4DEV and PMDPro (Rodríguez-Rivero et al., 2021, Golini et al., 2015, PM4DEV, 2014, PM4NGOs, 2020). Secondly, several donor agencies have come up with their own PM guidelines that they demand from, or at least recommend to, their implementing organisations during the project delivery phase (Alkhater, 2021, Rodríguez-Rivero et al., 2021).

Although these approaches might differ among aid-providing countries and institutions based on their cultures and the types of projects they finance, in general, they use the best practices from the business environment as a baseline that they adjust (Alkhater, 2021, Golini et al., 2015) to ensure greater responsiveness and flexibility (Saleh and Karia, 2020). Therefore, the PM guidelines developed by donors usually omit the profit-oriented tools such as earned-value management (EVM) (Golini et al., 2015) and put more emphasis on understanding the causes of the addressed challenges, on linking activities to the long-term goals or on monitoring the project status and ex-post evaluation (Ika et al., 2020, Golini et al., 2015, Tewes-Gradl et al., 2014).

Despite this shift to a more structured management of ID projects by the donor agencies, implementing organisations still seem rather reluctant to move to a more standardised approach (Czahajda, 2019, Montes-Guerra et al., 2015, Golini et al., 2015). Based on the research among Lithuanian, German (Keleckaite, 2015) and Portuguese (Matos, 2019) ID project leaders from the non-profit sector, only about half of them apply some PM tools on their projects and a majority of them admitted that they do so only to comply with the donor's requirements (Matos, 2019). Looking specifically at the CEE region in the scope of this study, the adoption rate of PM tools is even more limited with only about 18% of Polish NGO project managers indicating the use of some PM tools (Czahajda, 2019).

The adoption of project management tools beyond the donor's requirements highly depends on the willingness of the implementing organisation to train their project managers (Golini et al., 2015) and to see to their compliance with the set norms. Research on an international group of NGO and public project managers leading ID projects (Golini et al., 2015) suggests that the progress from basic to more advanced PM tools happens in stages based on the PM maturity of the implementing organisation. In the first stage, project managers and their organisations do indeed employ only the bare minimum of PM tools such as logical framework or status reports without any deeper understanding, only to be awarded the funding and later to comply with the donor's requirements. In case the project leaders decide to upskill, they usually do not start using all PM tools recommended by the standard methodology of their choosing but move to the second PM maturity stage which applies additional, though still rather basic, PM tools related to the Iron Triangle components, such as cost accounting and a Gantt chart, and risk management tools to control the challenging ID environment. Once proficient in these, project managers grow to the third PM maturity stage and employ more complex tools, such as responsibility

(RACI) matrix, stakeholder analysis or scope management. Project leaders in the highest PM maturity stage then apply all tools from the selected methodology (Golini et al., 2015).

The findings of this study set an important methodological model for further research, however, the division of individual PM tools into the PM maturity stages might need to be taken with caution as literature (Rodríguez-Rivero et al., 2021) suggests that the project management approaches might be culture-specific. Even though the standard methodologies are Western-based and should therefore more or less reflect the PM practices used in Western cultures, some differences in PM tool adoption are already visible among some European countries. While milestone planning, cost accounting and SWOT analysis are the most popular among Polish NGO project managers (Czahajda, 2019), their Lithuanian colleagues prefer work breakdown structure and risk management (Keleckaite, 2015). Yet another set of tools is applied in Germany where project leaders employ logical framework, Gantt chart and work breakdown structure the most (Keleckaite, 2015).

The application of PM tools by ID professionals from non-profit and public sectors across various cultures is summarized in Table 1 below. This table has been adjusted from a previous conference paper of the author (Dufková and Sejkora, 2020) that offers also more details about each of the project management tool listed. The table is based on the research among an international sample of project managers leading ID projects (Golini et al., 2015) and lists in the first three columns all project management maturity stages, PM tools used in each stage and their adoption rate by the international sample of ID project managers. Further columns indicate the use of these tools among project managers from single cultures, namely Poland (Czahajda, 2019), Portugal (Matos, 2019), Lithuania (Keleckaite, 2015), Germany (Keleckaite, 2015), and Spain (Montes-Guerra et al., 2015). The adoption of a PM tool is left blank in case the culture-specific research did not consider this tool.

Literature (Ika and Donnelly, 2017, Rodríguez-Rivero et al., 2021, Golini et al., 2015) indicates that the adoption of PM methodologies and their tools is an important factor that may increase the chance of project success. Internal project success refers to the Iron Triangle components, namely finishing the project within the planned timeframe, budget and in the planned scope and quality (Lazima a Coyle, 2019, PM4DEV, 2014), whereas external project success refers to the broader project impact, such as stakeholder involvement and satisfaction, economic sustainability after the project end, achieving long-term outcomes, and good monitoring and reporting (Golini et al., 2015, Boakye and Liu, 2017, Eja and Ramegowda, 2020).

Several culture-specific and general international studies (Golini et al., 2015, Montes-Guerra et al., 2015, Ika, 2015, Czahajda, 2019) have therefore explored the link between individual PM tools and the project performance. As per the internal project results, the studies agree that these are positively affected by the use of budget, schedule and scope-related tools such as cost accounting, Gantt chart, milestone planning, scope and risk management. Furthermore, international research (Golini et al., 2015, Ika, 2015) highlights the positive impact of the often-compulsory tools, i.e., status reports and logical framework. Based on an international study (Golini et al., 2015), the external results are positively influenced by tools connected to people management such as stakeholder management, RACI matrix, organizational chart, and communication plan. Last but not least, the contingency allocation also might have a positive impact on the external project

performance. The findings of the existing literature are summarised in Table 2 below that was adjusted from a previous conference paper by the author (Dufková and Sejkora, 2020) that offers more insight into each of the project performance categories listed.

Table 1. Application of project management tools in international development

PM stages (Golini et al., 2015)	Project management tools	International research (Golini et al., 2015)	Poland (Czahajda, 2019)	Portugal (Matos, 2019)	Lithaunia (Keleckaite, 2015)	Germany (Keleckaite, 2015)	Spain (Montes-Guerra et al., 2015)
Stage 1	Logical framework	Most common	Not common	Most common	Common	Most common	Most common
Stage 1	Progress reports	Most common		Most common			Most common
Stage 2	Cost accounting	Most common	Most common	Most common	Most common	Most common	Most common
Stage 2	Risk management	Most common	Common	Common	Common	Not common	
Stage 2	Gantt chart	Most common	Common	Most common	Not common	Most common	Common
Stage 3	Communication plan	Common		Most common			
Stage 3	Milestone planning	Common	Most common	Not common			
Stage 3	Organisational chart	Common		Common			
Stage 3	Contingency allocation	Common					
Stage 3	Stakeholder analysis	Common	Common	Common	Not common	Most common	
Stage 3	Scope management	Common		Most common			
Stage 3	RACI matrix	Common	Not common	Not common			
Stage 4	Work breakdown structure	Not common	Common	Not used	Most common	Most common	
Stage 4	Critical path method	Not common	Not common	Not used	Not common	Not common	Not used
Stage 4	Issue log	Not common					
Stage 4	Earned-value management	Not common	Not common	Not used	common	Not common	

Source: adjusted from a previous conference paper of the author (Dufková and Sejkora, 2020).

Table 2. PM tools and their impact on project success

Project success	International (Golini et al., 2015)	Poland (Czahajda, 2019)	Spain (Montes-Guerra et al., 2015)	International (Ika, 2015)
Internal project success	Progress reports Logical framework Cost accounting Gantt chart Risk management Communication plan Organisational chart	Budget management tools Milestone planning	Time management tools Budget management tools Scope management tools	Reporting tools Monitoring tools
External project success	Milestone planning Stakeholder analysis Contingency allocation RACI matrix			

Source: adjusted from a previous conference paper of the author (Dufková and Sejkora, 2020).

As mentioned in the Introduction section, all these studies consider only non-profit and public actors, completely omitting the new for-profit businesses active in the industry. Nevertheless, they are still relevant as a basis for further research for several reasons. Firstly, although private firms increasingly engage in the ID industry, the traditional non-profit and public actors still remain the prevalent implementing partners, especially in the CEE region. While Hungary and the Czech Republic promote private sector engagement and channelled 12.4% and 6.6% respectively of their bilateral ODA flows in 2021 through companies (OECD, 2023b), Poland and Slovakia still depend mostly on the traditional actors as they channelled 0% and only 1.2% respectively of their bilateral ODA flows in 2021 through private firms (OECD, 2023b). Secondly, as mentioned by Rodríguez-Rivero et al. (2021), the use of PM practices might be culture-specific and the existing findings might thus serve as a baseline to identify regional culture specifics. Thirdly, their methodological approaches are still valid and will be used for this CEE analysis, which will be described in more detail in the following chapter.

Methodology

For the purpose of this study, a new data set was collected among project managers leading international development projects funded by the Czech Republic, Hungary, Poland and Slovakia. The data was collected in the form of on-line surveys in four language mutations (Czech, Polish, Hungarian and English) between November 2021 and November 2022. The Czech version was also used for Slovakian project leaders. All surveys were reviewed by native speakers and a trial was run with several project managers to ensure clarity of the survey questions and translations. The collection was negatively influenced by the current situation in Ukraine as many – especially Polish – managers expressed their time constraint and inability to complete the survey at that time, and the data collection was therefore prolonged in order to obtain as many responses as possible.

To identify project managers to contact, organizations implementing ID projects for the selected CEE donors between 2016 and 2021 were found from the donor agencies' websites, annual and other reports, press releases, from various business platforms and directly from the donor agency in the case of the Czech Republic. Organisations running ID projects funded by these states in previous years were excluded from the scope of this study as they might no longer possess the knowledge about the projects and as they might have had different requirements from the donors. Organisations were linked to states based on the donor agency funding their projects and not based on their headquarters as PM requirements might differ between agencies: Czech organisations might, thus, for instance, apply different PM tools on projects funded by the Czech Republic and by Hungary.

The sampling frame included 357 organisations and 726 project managers, which is likely to capture the whole population of organisations that ran ID projects financed by the selected CEE donors in the given time period. These organisations and their project managers were then contacted directly via email and LinkedIn or the company websites, and in the end, 159 responses were collected, out of which 132 were complete and could be used in this analysis. The data were obtained from all sectors currently implementing ID projects for the CEE donors, i.e., non-profit (including NGOs, religious organisations and foundations), for-profit, and other organisations (including universities, municipalities and state institutions).

The final sample used for this study is not significantly out of kilter with the population, however, several limitations need to be mentioned. Firstly, the response rate in the Czech Republic, Hungary and Slovakia is roughly similar, but it is lower among Polish project managers. Secondly, as the engagement of the private sector is still very limited in Poland, there are no responses from Polish businesses in the study. When looking at the organisation size, the final sample is representative because the majority of responses comes from micro and small organisations. Information about the initial sampling frame and the final sample are summarised based on countries and sectors in Table 3.

Table 2. Summary of the project managers contacted and responses received

Project success	Czech Republic	Hungary	Poland	Slovakia
Organisations selected	109	66	94	88
Project managers contacted	233	142	192	159
Total responses	52	31	37	39
Complete responses	45	26	28	33
Response rate	19.3%	18.3%	14.6%	20.7%
- non-profit	26.7%	17.4%	14.3%	23.2%
- for-profit	13.4%	18.4%	0.0%	22.7%
- state institutions	23.3%	50.0%	33.3%	7.1%
- universities	22.2%	20.0%	40.0%	0.0%
Complete responses collected				
- non-profit	21	15	23	22
- for-profit	16	9	0	10
- state institutions	6	1	3	1
- universities	2	1	2	0
Organisation size (people employed)				
- 1-9	24%	33%	33%	47%
- 10-49	28%	26%	35%	25%
- 50-249	10%	12%	16%	8%
- 250-449	21%	9%	3%	7%
- 500 or more	17%	20%	13%	14%

Source: created by the author.

The survey consisted of several parts. At the beginning, the project managers were asked about their project management experience in years and then to indicate information about their projects, specifically the average project duration in years and the average project budget size, which was grouped into three categories, i.e., up to 40k EUR sharp marked as 1, from 40k EUR up to 160k EUR sharp marked as 2, and more than 160k EUR marked as 3. Furthermore, project managers were asked about the size of their organisation: 0-249 employees marked as 1, from 250 to 499 employees marked as 2, and more than 500 employees marked as 3. Based on the survey results, the experience of project managers varies significantly, starting from very fresh project managers with zero experience to very experienced ones with over 40 years in the PM field. The average experience is similar across all countries, however, managers leading Czech ID projects are on average slightly more experienced than others. As for project information, the projects are on average two years long and with a budget from 40k EUR up to 160k EUR. And last but not least, the organisations implementing CEE ID projects are on average

small organisations of up to 249 employees. The descriptive statistics for this part of the survey is presented in Table 7 in the appendix.

In the following section, the project managers were asked about the PM tools they apply in their projects and about the importance they place on these tools on a Likert scale from 1 (the least important) to 5 (the most important), if used. The PM tools in question are inspired by the research discussed in the previous chapter and thus include logical framework, progress report, cost accounting, risk management, Gantt chart, communication plan, milestone planning, organisational chart, contingency allocation, stakeholder analysis, scope management, responsibility matrix, work breakdown structure, critical path method, issue log and earned-value management.

In general, the adoption and importance of PM tools are roughly similar for all four selected CEE countries, which makes it possible to consider the entire region as one data set in the following analysis. Answering the first research question, i.e., what PM tools are used by all sectors on the CEE ID projects, the most commonly used PM tools by the surveyed project leaders in all four CEE countries are milestone planning, status report, communication plan, cost accounting and risk management, all being applied by more than 80% of the surveyed project managers. On the other side of the spectrum, the responsibility matrix, earned-value management, and critical path method are the least important, with less than a 40% adoption rate. If used in all selected CEE countries, project managers find tools focused on budget and schedule, i.e., cost accounting and milestone planning, the most crucial, which is then followed by the tools often required by the funding donor agencies, namely status reports and logical framework.

Nevertheless, some slight cultural specifics can be observed as the use of PM tools is, in general, lower in Poland compared to the other three countries, which confirms the existing findings of Czahajda (2019) of the limited PM tool usage in this country. Based on the survey results, a lower share of Polish project managers compared to their colleagues from the other three countries employs logical framework, issue log, responsibility matrix and critical path method. As per other countries, the work breakdown structure seems to be more popular in Hungary, while the Gantt chart is applied more often in the Czech Republic. If the PM tools are used, there are, however, no significant cultural differences in terms of the importance the project leaders place on them. The adoption rate of the individual tools and their importance, if used, in total and per country, is presented in Table 8 in the appendix in order from the most adopted to the least adopted.

In the last part of the survey, project managers were asked to evaluate on a Likert scale from 1 (the best) to 5 (the worst) how successful they think their projects were in several categories. Three categories were related to the internal Iron Triangle project results and included finishing the project within the planned budget, schedule and scope. The remaining five categories were connected to the external project results and included economic sustainability after the project end, obtaining long-term impact and satisfaction of the aid-receivers, stakeholder involvement, and monitoring and reporting. These categories were selected based on the existing research mentioned in the previous chapter.

A limitation of this approach is that the results are self-evaluated and might thus be influenced by personal perceptions or the unwillingness to admit failures. However, the use of self-evaluated results is a common practice among similar studies (Golini et al., 2015). To mitigate the risk of bias, several measures were taken. During the collection phase,

the survey was anonymous and the project managers were repeatedly assured of the anonymity of their answers. After the data collection phase, a simple sense check was conducted in the case of the Czech Republic – due to the unavailability of data, a similar check was unfeasible for the other three countries.

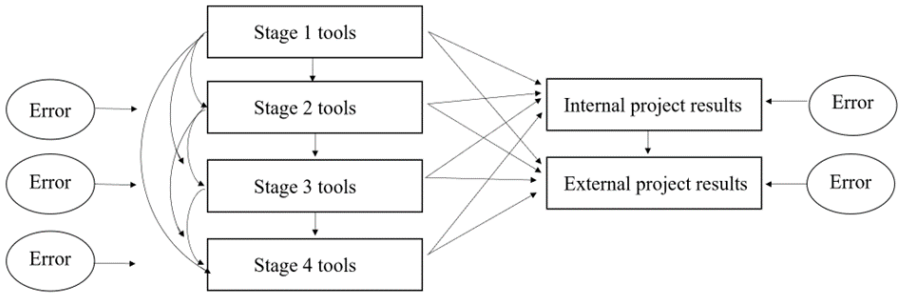
As per the Iron Triangle constraints of budget and time, Czech project managers marked themselves on average with 1.44 for delivering their projects within budget, and slightly worse, 1.86, for delivering the project within the planned schedule. This seems to be in line with the existing findings (Dufková, 2022) that suggest that out of all bilateral projects funded by the Czech Republic between 2016 and 2019, only 6% finished with a budget overrun, while a slightly higher share of 16% ended up with a delay. From the external categories, Czech project managers marked themselves as the worst in economic sustainability after the project end (average mark 2.49). A review of relevant independent project evaluation reports publicly available on the website of the Czech Ministry of Foreign Affairs (Ministerstvo zahraničních věcí České republiky, 2023) was performed and the results of this analysis seem to correspond with the project managers' self-evaluation because the sustainability was assessed as low and rather low for 56% of the projects – the worst result from all the evaluation criteria.

Based on the survey results, finishing within the given budget was evaluated as the best criterion for all four CEE countries in general (mark 1.55), but also individually for the Czech Republic and Poland. Hungarian and Slovak project managers are then most content with the satisfaction of the aid-receivers of their ID projects. On the other side of the spectrum, all project managers, regardless of their country, assessed economic sustainability after the project end as the worst result category. The answers in total and per country for each result category are summarised in Table 9 in the appendix. The categories are listed in order from the best to the worst.

To estimate the number of project management maturity stages and to decide on the PM tools included in each stage, a two-step cluster analysis was conducted, using the importance values of each tool. In case the tool was not adopted by the project manager, the value was set to zero. A hierarchical cluster analysis based on the Euclidean distance and Ward method was performed first and this analysis suggested dividing the data into four clusters. To assign the project management tools to the identified clusters, the K-means clustering algorithm was followed. As a final step of this cluster analysis, an average importance value was calculated for each tool.

To evaluate the impact the project management tools might have on the project results, structural equation modelling (SEM) was performed. Firstly, a hypothesised model was specified that suggested the impact of the tools in the four PM maturity stages on internal and external project performance. It furthermore suggested the existence of a progressive relationship between the PM maturity stages, i.e., that the tools adopted in the early stages might influence the adoption of tools in the later stages (Golini et al., 2015). A similar relationship was suggested between the internal and external results as well as project leaders that manage the Iron Triangle constraints better might also have a higher chance of achieving external project success (Golini et al., 2015). The hypothesised model used in this study is pictured in Figure 1 below.

Figure 1. Important figure



Source: created by the author.

The values of the PM stage variables for each project manager were calculated as the average importance values for the tools used in the given stage. Similarly, the values for internal and external project results were taken as the average ranking of the relevant categories for each project manager. There is no strict rule to define the minimum sample size for SEM (Westlan, 2010, Ranatunga et al., 2020), however, a commonly recommended criterion to have at least 10 observations per indicator (Westlan, 2010, Ranatunga et al., 2020, Wolf et al., 2013, Hoe, 2008) was met in the analysis as the smallest cluster consisted of 22 observations.

To determine whether and to what degree the structural equation model fits the data set, a goodness-of-fit analysis was conducted. Based on the literature review (Xia and Yang, 2018, Schermelleh-Engel et al., 2003, Browne and Cudeck, 1993, Hu and Bentler, 1999, Hoe, 2008) three goodness-of-fit indices have been selected that would suit best the relatively small sample size and the data collected through a Likert scale: 1-Root Mean-Square-Error (1-RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI). Reasonable cutoff values vary based on the literature, however, the hypothesised model passes all the recommended values. The results of the goodness-of-fit analysis, together with the recommended cutoff values and supporting literature are summarised in Table 4 below.

Table 4. Goodness-of-fit statistics

Project success	Value	Recommended	Literature
1-Root Mean-Square-Error (1-RMSEA)	0.000	≤ .05	Xia and Yang, 2018, Schermelleh-Engel et al., 2003, Browne and Cudeck, 1993, Hoe, 2008
Comparative Fit Index (CFI)	1.000	≥.90 or ≥.95	Xia and Yang, 2018, Schermelleh-Engel et al., 2003, Hu and Bentler, 1999, Hoe, 2008
Tucker-Lewis Index (TLI)	1.000	≥.90 or ≥.95	Xia and Yang, 2018, Hu and Bentler, 1999, Hoe, 2008

Source: created by the author.

Finally, the model estimation was performed in R Studio using the lavaan language.

Results

Table 5 below provides the results of the cluster analysis and describes the findings of the second research question regarding the adoption of project management tools based on maturity stages. The analysis indicates that the adoption of PM tools among the surveyed project leaders in the four CEE countries indeed progresses in sequential stages. Similar to the international research (Golini et al., 2015), it suggests that there are four PM maturity levels, however, it points out cultural specifics of the CEE countries as the tools adopted in each stage by the surveyed CEE project leaders differ from those applied by the international sample.

In the lowest PM maturity stage 1, the surveyed CEE project managers employ only the bare minimum of tools, which confirms the existing findings of Golini et al. (2015) that the first stage applies only basic tools in order to comply with the donor's requirements. Based on the received answers, the stage 1 tools in the CEE context include logical framework and milestone planning. The latter was applied only in stage 3 in the international sample (Golini et al., 2015), however, as ID projects in CEE are often evaluated and financed on a yearly basis, it might be crucial for the project leaders to plan what milestones can be achieved in the given period in order to specify the scope and secure funding.

The PM maturity stage 2 constructed based on the survey answers is far more advanced than the international stage 2 (Golini et al., 2015) as it includes cost accounting, status reports, communication plan, risk and scope management, and organisational chart. There might be several explanations for this fact. Firstly, the original research is already of older date and the project managers in stage 2 might have upskilled in the meantime. Secondly, ID projects are nowadays implemented also by private firms that might use additional PM tools compared to their non-profit counterparts.

The PM maturity stage 3 constructed based on the survey answers then adds only a few new tools as most of the ones applied by the international sample (Golini et al., 2015) are already adopted in the previous stage in the CEE context. The additional tools used in stage 3 are the Gantt chart, stakeholder matrix and the work breakdown structure. Finally, the remaining PM tools, i.e., the issue log, contingency allocation, critical path method and earned-value management system are only applied by project managers in the highest stage 4.

The results of the cluster analysis and the comparison to the international research are summarised in Table 5.

The following Table 6 below summarises the results of the SEM analysis and brings three main findings. Firstly, the model supports the hypothesis that PM tools are adopted progressively as the tools employed in previous stages affect the use of the tools in the subsequent stages. Stage 1 tools therefore show a significant positive impact on the adoption of stage 2 tools (E=0.489, p=0.000) and stage 3 tools (E=0.302, p=0.001). Similarly, stage 2 tools positively influence the adoption of stage 3 tools (E=0.327, p=0.001) and stage 4 tools (E=0.455, p=0.000). The only exception to this finding is the highest stage 4 that is not influenced by the lowest stage 1 tools (E=0.038, p=0.602). Although the surveyed project managers in the highest PM maturity stage see stage 1 tools as highly important (milestone planning was marked with 4.45 and logical framework with 3.79), they might

already consider these tools as a basic bread-and-butter and a positive impact on the adoption of stage 4 tools might thus not show.

Table 5. Results of the cluster analysis and comparison to international research

Project success	International research (Golini et al., 2015)	Stage 1	Stage 2	Stage 3	Stage 4
Milestone planning	Stage 3	2.09	3.84	3.76	4.45
Logical framework	Stage 1	1.82	2.41	3.29	3.79
Cost accounting	Stage 2	0.54	4.25	4.16	4.48
Status report	Stage 1	0.77	3.90	3.92	4.34
Communication plan	Stage 3	1.23	3.55	3.45	4.24
Risk management	Stage 2	0.86	2.86	3.84	4.51
Scope management	Stage 3	0.27	2.67	1.88	4.07
Organisational chart	Stage 3	1.14	2.00	3.42	4.03
Gantt chart	Stage 3	1.63	1.14	3.63	3.24
Stakeholder matrix	Stage 3	0.91	0.25	2.82	3.79
Work breakdown structure	Stage 4	0.41	1.69	2.16	3.65
Issue log	Stage 4	0.36	1.09	1.29	3.75
Contingency allocation	Stage 3	0.09	1.51	1.74	3.66
Responsibility matrix	Stage 3	0.23	0.67	1.21	3.58
Critical path method	Stage 4	0.00	0.44	0.89	3.41
Earned-value management	Stage 4	0.09	1.02	0.55	3.28
Number of project managers		22	43	38	29
Share of project managers		17%	33%	29%	22%

Source: created by the author.

Secondly, Table 6 presents the SEM regression results of each PM maturity stage on the internal and external project outcomes. It answers the third research question and suggests that the internal performance of projects implemented by the project leaders in the sample is positively influenced by the stage 1 tools (E=-0.073, p=0.095). The adoption of these tools might thus contribute to the improvement of internal project outcomes. The negative estimation sign is given by the reverse ranking scales in the survey where 1 is the lowest tool importance but the best project result. As stage 1 tools are often required by the CEE donor agencies from their implementing organisations, these findings indicate that (1) these donors have selected appropriate PM requirements to positively influence their internal project performance and (2) that project managers leading these projects have already mastered these two basic tools, so that the tools can help them deliver their projects successfully. Other stages do not have any significant impact on the internal project results.

Based on the survey answers, no tool has any direct significant impact on the external project performance. However, thirdly, the study indicates that the broader external project performance is strongly and positively affected by the internal project result (E=0.734, p=0.000), meaning that the external outcomes are indirectly influenced by stage 1 tools

that positively affect the successful achievement of internal outcomes. Project leaders who succeed in completing their projects within the given deadline, budget and with the planned scope have thus also higher chance of achieving higher stakeholder satisfaction, long-term impact and economic sustainability after the project end, better local ownership, and better monitoring and reporting. This confirms the findings of the existing international research (Golini et al., 2015) that the short-term internal performance can have a positive influence on the long-term results.

The results of the analysis are presented in Table 6.

Table 6. Results of SEM analysis

Regressions	Impact	Estimate	Std.Err	z-value	P(>|z|)
Stage 2 ~					
Stage 1	Significant	0.489	0.070	7.022	0.000
Stage 3 ~					
Stage 1	Significant	0.302	0.089	3.405	0.001
Stage 2	Significant	0.327	0.095	3.460	0.001
Stage 4 ~					
Stage 1	Not significant	0.038	0.073	0.522	0.602
Stage 2	Significant	0.455	0.078	5.816	0.000
Stage 3	Significant	0.371	0.069	5.375	0.000
Internal ~					
Stage 1	Significant	-0.073	0.043	-1.668	0.095
Stage 2	Not significant	0.022	0.052	0.425	0.671
Stage 3	Not significant	0.053	0.045	1.171	0.242
Stage 4	Not Significant	0.046	0.052	0.896	0.370
External ~					
Stage 1	Not significant	-0.042	0.042	-0.986	0.324
Stage 2	Not significant	0.015	0.050	0.307	0.759
Stage 3	Not significant	-0.015	0.044	-0.350	0.726
Stage 4	Not significant	-0.063	0.050	-1.263	0.207
Internal	Significant	0.734	0.084	8.757	0.000

Source: created by the author.

The limited impact of the tools from higher stages on the internal and external project results compared to the international research might be explained by different project characteristics. On average, the surveyed CEE project leaders ran smaller and shorter projects which might be easier to manage and might thus not offer the opportunity to utilise and benefit from the more advanced tools. The international project managers (Golini et al., 2015), on the other hand, ran projects of bigger budget sizes and longer duration that might require more complex PM practices to be delivered successfully.

Conclusion

This article focused on project management tools adopted on international development projects and their impact on project performance. Project management in the ID industry stayed for a long time out of the scope of the mainstream PM literature and research due

to their specific nature (Ika et al., 2020, Matos, 2019, Ahsan and Gunawan, 2010) and specialised approaches have been therefore developed by donors and independent professional bodies only in the new millennium (Rodríguez-Rivero et al., 2021, Alkhater, 2021).

Based on the findings and methodology of the existing research (Golini et al., 2015, Montes-Guerra et al., 2015, Czahajda, 2019), this study looks deeper at four selected Central and Eastern European donors, namely the Czech Republic, Hungary, Poland and Slovakia, and aims to establish what PM tools are used on ID projects funded by these donors, how they are adopted and how they influence the internal and external performance of these projects. To do so, a new dataset was collected in the form of an online survey among project managers from all sectors leading ID projects for these donors between 2016 and 2021. Based on its results, the most commonly used tools are milestone planning, status report, communication plan, cost accounting and risk management which are applied by more than 80% of the surveyed project managers. As per the tool's importance, project managers find cost accounting and milestone planning the most essential, which is then followed by status reports and a logical framework. The survey suggests that there are some slight differences between the four countries. Firstly, the adoption of PM tools is limited in Poland, secondly, Hungarian project managers find the work breakdown structure more popular than their CEE colleagues, and thirdly, the Czech project leaders are more inclined to use the Gantt chart.

Furthermore, the study confirms that PM tools are adopted progressively (Golini et al., 2015) and brings a clear division of these tools into four PM maturity stages for the surveyed CEE project managers. Project leaders in the lowest PM maturity stage employ only basic tools, milestone planning and logical framework, in order to comply with donors' requirements, while project leaders in higher PM maturity levels adopt a greater variety of tools on their projects. The results suggest that the division of tools into the PM stages is culture-specific (Rodríguez-Rivero et al., 2019), as the tools included in each stage differ from the research conducted on a sample of international project managers (Golini et al., 2015).

Last but not least, the article provides empirical evidence based on the collected survey data that the adoption of the tools from the first PM maturity stage has a positive and significant impact on the internal project results, and their adoption can thus contribute to the improvement of project performance in terms of delivering the project within the planned budget, schedule and scope. None of the PM maturity stages shows any direct positive impact on the external project results, and this performance is thus positively affected only by the internal project outcomes. This means that a project manager who achieves better internal results has a greater chance of delivering the project successfully also externally.

These findings might be of particular interest to the four CEE donors and project managers implementing their projects. The donor agencies already request the use of the logical framework and often also milestone planning, so the study suggests a slight policy implication to diligently control the use of these two tools as the internal project results might be enhanced by their adoption.

This study is, however, not free from limitations. Firstly, it analysed a relatively small data sample consisting of 132 project managers. Secondly, the results assessed in this

study are self-evaluated and although several measures were taken to mitigate the risk of bias, this fact should be taken into consideration when further interpreting the results.

The paper offers also opportunities for further research. The research focused on traditional PM tools listed in PMBOK, PM4DEV and PMDPro methodologies. However, new PM approaches such as Agile and Waterfall might be considered in future analysis. Furthermore, future research might consider whether the implementation of the PM requirements from the donor agencies might restrict some actors from being awarded the project, especially if these actors are from other cultures such as the aid-receiving countries.

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Appendix

Table 7. Manager, organisation and project information.

	Average	Standard deviation	Min	Max
Years of experience	9.45	7.09	0.00	43.00
- Czech Republic	10.44	8.88	0.00	43.00
- Hungary	9.60	6.62	1.50	20.00
- Poland	9.89	6.41	1.00	30.00
- Slovakia	7.61	4.85	1.00	18.00
Average project duration	2.07	1.29	0.30	7.00
- Czech Republic	2.28	1.35	1.00	7.00
- Hungary	1.98	1.12	0.38	5.00
- Poland	2.21	1.61	0.50	6.00
- Slovakia	1.76	1.00	0.30	6.00
Project size	2.34	0.73	1.00	3.00
- Czech Republic	2.38	0.81	1.00	3.00
- Hungary	2.15	0.78	1.00	3.00
- Poland	2.54	0.69	1.00	3.00
- Slovakia	2.27	0.57	1.00	3.00
Organisation size	1.41	0.78	1.00	3.00
- Czech Republic	1.76	0.87	1.00	3.00
- Hungary	1.50	0.86	1.00	3.00
- Poland	1.43	0.84	1.00	3.00
- Slovakia	1.06	0.35	1.00	3.00

Source: created by the author.

Table 8. Adoption rate and importance of project management tools

	Adoption	Average	Standard deviation	Min	Max
Milestone planning	89%	4.13	0.89	1.00	5.00
- Czech Republic	96%	3.91	1.07	1.00	5.00
- Hungary	85%	4.36	0.73	3.00	5.00
- Poland	89%	4.16	0.69	3.00	5.00
- Slovakia	82%	3.50	0.81	1.00	5.00
Status report	86%	4.08	0.90	2.00	5.00
- Czech Republic	84%	4.05	0.98	2.00	5.00
- Hungary	81%	4.19	0.81	3.00	5.00
- Poland	82%	4.04	0.77	2.00	5.00
- Slovakia	94%	4.07	0.96	2.00	5.00
Communication plan	86%	3.81	1.04	1.00	5.00
- Czech Republic	87%	3.67	1.01	1.00	5.00
- Hungary	85%	3.73	1.16	1.00	5.00
- Poland	79%	3.55	0.91	2.00	5.00
- Slovakia	94%	4.23	0.99	2.00	5.00
Cost accounting	85%	4.31	0.89	2.00	5.00
- Czech Republic	89%	4.23	0.92	2.00	5.00
- Hungary	88%	4.48	0.79	2.00	5.00
- Poland	82%	4.65	0.57	3.00	5.00
- Slovakia	79%	4.00	1.06	2.00	5.00
Risk management	80%	3.99	0.94	1.00	5.00
- Czech Republic	78%	3.86	1.03	1.00	5.00
- Hungary	81%	3.95	0.97	2.00	5.00
- Poland	75%	4.00	0.84	2.00	5.00
- Slovakia	85%	4.18	0.86	2.00	5.00
Organisational chart	74%	3.65	1.03	1.00	5.00
- Czech Republic	82%	3.51	1.10	1.00	5.00
- Hungary	65%	3.47	0.94	2.00	5.00
- Poland	54%	3.53	0.83	2.00	5.00
- Slovakia	88%	4.00	1.04	2.00	5.00
Logical framework	70%	4.08	1.14	1.00	5.00
- Czech Republic	84%	4.21	1.07	1.00	5.00
- Hungary	73%	4.37	0.96	2.00	5.00
- Poland	46%	3.62	1.26	1.00	5.00
- Slovakia	70%	3.87	1.25	1.00	5.00
Gantt chart	67%	3.60	1.08	1.00	5.00
- Czech Republic	73%	3.27	1.04	1.00	5.00
- Hungary	65%	4.06	0.97	2.00	5.00
- Poland	57%	3.56	1.09	1.00	5.00
- Slovakia	67%	3.77	1.11	2.00	5.00
Scope management	66%	3.48	1.13	1.00	5.00
- Czech Republic	69%	3.55	1.18	1.00	5.00
- Hungary	69%	3.17	1.30	1.00	5.00
- Poland	54%	3.67	0.90	2.00	5.00
- Slovakia	70%	3.52	1.08	2.00	5.00
Stakeholder matrix	58%	3.26	1.30	1.00	5.00
- Czech Republic	64%	3.14	1.36	1.00	5.00
- Hungary	65%	3.53	1.13	1.00	5.00
- Poland	32%	3.00	1.12	1.00	4.00

- Slovakia	64%	3.33	1.46	1.00	5.00
Contingency allocation	55%	3.32	1.13	1.00	5.00
- Czech Republic	56%	3.44	1.19	1.00	5.00
- Hungary	69%	3.44	1.25	1.00	5.00
- Poland	46%	3.31	1.04	1.00	5.00
- Slovakia	48%	3.00	1.21	1.00	5.00
Work breakdown structure	55%	3.75	1.07	1.00	5.00
- Czech Republic	51%	3.78	1.09	2.00	5.00
- Hungary	73%	4.00	1.11	1.00	5.00
- Poland	46%	3.23	0.83	2.00	5.00
- Slovakia	52%	3.82	1.13	1.00	5.00
Issue log	48%	3.33	1.13	1.00	5.00
- Czech Republic	49%	2.86	1.21	1.00	5.00
- Hungary	54%	3.57	0.94	2.00	5.00
- Poland	32%	3.33	0.87	2.00	5.00
- Slovakia	58%	3.68	1.16	1.00	5.00
Responsibility matrix	39%	3.61	1.04	1.00	5.00
- Czech Republic	40%	3.56	0.70	2.00	5.00
- Hungary	46%	3.75	1.22	1.00	5.00
- Poland	18%	3.80	0.84	3.00	5.00
- Slovakia	48%	3.50	1.32	1.00	5.00
Earned value management system	37%	3.31	1.14	1.00	5.00
- Czech Republic	33%	3.20	1.15	1.00	5.00
- Hungary	46%	3.33	1.30	1.00	5.00
- Poland	29%	3.13	1.46	1.00	5.00
- Slovakia	42%	3.50	0.85	2.00	5.00
Critical path method	34%	3.38	1.03	1.00	5.00
- Czech Republic	31%	3.43	0.85	2.00	5.00
- Hungary	46%	3.00	1.13	1.00	5.00
- Poland	18%	3.80	0.84	3.00	5.00
- Slovakia	42%	3.50	1.16	1.00	5.00

Source: created by the author.

Table 9: Self-evaluated results

Self-evaluated results	Average	Standard deviation	Min	Max
Staying within the planned budget	1.55	0.69	1.00	5.00
- Czech Republic	1.44	0.59	1.00	3.00
- Hungary	1.77	1.03	1.00	5.00
- Poland	1.57	0.57	1.00	3.00
- Slovakia	1.52	0.57	1.00	3.00
Satisfaction of the receivers	1.63	0.70	1.00	4.00
- Czech Republic	1.60	0.63	1.00	3.00
- Hungary	1.65	0.75	1.00	4.00
- Poland	1.85	0.82	1.00	4.00
- Slovakia	1.46	0.62	1.00	3.00
Keeping the planned scope and quality	1.71	0.71	1.00	4.00
- Czech Republic	1.58	0.66	1.00	4.00
- Hungary	1.89	0.76	1.00	4.00
- Poland	1.96	0.67	1.00	3.00
- Slovakia	1.55	0.71	1.00	3.00
Monitoring and reporting	1.74	0.76	1.00	4.00
- Czech Republic	1.65	0.72	1.00	3.00
- Hungary	1.73	0.92	1.00	4.00
- Poland	2.07	0.73	1.00	3.00
- Slovakia	1.61	0.66	1.00	3.00
Stakeholder involvement	1.95	0.99	1.00	5.00
- Czech Republic	1.86	1.03	1.00	5.00
- Hungary	1.96	1.08	1.00	4.00
- Poland	2.19	1.00	1.00	4.00
- Slovakia	1.88	0.87	1.00	4.00
Staying within the planned deadline	2.01	0.81	1.00	4.00
- Czech Republic	1.86	0.86	1.00	4.00
- Hungary	1.96	0.96	1.00	4.00
- Poland	2.30	0.61	1.00	3.00
- Slovakia	2.00	0.97	1.00	4.00
Obtaining long-term project impact	2.21	1.03	1.00	5.00
- Czech Republic	2.33	0.92	1.00	5.00
- Hungary	2.15	1.12	1.00	5.00
- Poland	2.37	1.04	1.00	5.00
- Slovakia	1.97	1.07	1.00	5.00
Economic sustainability after the project end	2.40	1.11	1.00	5.00
- Czech Republic	2.49	1.12	1.00	5.00
- Hungary	2.31	1.12	1.00	5.00
- Poland	2.78	1.12	1.00	5.00
- Slovakia	2.03	0.98	1.00	5.00

Source: created by author.