

UNWRAPPING THE SOFTWARE PROJECT PERFORMANCE: INVESTIGATING THE ROLE OF HUMAN RESOURCE ANALYTICS ADOPTION AND TASK PERFORMANCE IN THE TELECOM SECTOR

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Abstract

This research investigates the impact of HR analytics on project performance through the mediating role of task performance. Data was collected from 320 professionals in the telecom sector of Pakistan using purposive sampling, and the obtained data was analysed through SPSS and using the Hayes PROCESS macro to test direct and indirect relationship. The results show that HR analytics adoption positively impacts software project performance, with task performance mediating this relationship. These results demonstrate the significance of HR analytics in enhancing individual task performance, which ultimately contributes to the overall success of projects. This research expands HR analytics literature by offering empirical evidence from a developing country and deliver practical knowledge for organizations seeking to use analytics-based HR systems to improve software project outcomes.

1. Introduction

The increasing use of facts to make decisions has essentially redefined the way an organisation manages human capital, especially in a knowledge-based and technology-driven workplace. HR analytics adoption is one of these developments, and it has become a strategic capability that helps organisations to collect, analyse, and use workforce data in a systematic way to enhance managerial decisions and the final performance results (Fernandez and Gallardo-Gallardo, 2021). The HR analytics adoption implicates the degree to which organisations incorporate analytic devices, metrics, and predictive models in HR activities to make decisions that pertain to staffing, performance control, and skill advancement

(Dasari and Devi, 2025). With the growing reliance on digitalised and highly complex systems at the organisational level, the applicability of HR analytics has become particularly acute in the scenario of software projects, where human knowledge and task performance are key to success. Software development projects are highly uncertain, technologically volatile, and most of the tasks are interdependent, with a large amount of knowledge sharing among the team members (Khattak et al., 2022).

These features ensure that the performance of software projects is very sensitive to changes in the individual and team-level work behaviour. Various criteria are commonly used to measure software project performance, such as

compliance with the time and cost schedule, quality of the software, user satisfaction, and fulfilling the functional requirements (Khan et al., 2020). In spite of the development improvement methods and tools in place, software projects still have a high failure rate, which, according to many, is often due to human and organisational causes and not necessarily to a technical problem (Khattak et al., 2024). The fact that this issue remains continues to highlight the necessity to explore the scope of how strategic HR practices, in this case, the adoption of HR analytics, can contribute to better performance outcomes in software projects.

Previous studies already identified HR analytics as a tool for enhancing organisational success through aligning human capital decisions with strategic purposes (Dasari and Devi, 2025). Research claims that the analytics-based HR systems contribute to better workforce planning, performance assessment, and talent utilisation by delivering timely and evidence-based information (McCartney and Fu, 2022). Most of the available literature, however, is concerned with the results at the firm-level, like productivity or financial performance, and does not address the context of the project, like software development (Arora et al., 2023).

Consequently, the processes in which the adoption of HR analytics has an impact on the performance of software projects are poorly comprehended. Task performance is one of the most important but under-researched mechanisms of relating HR analytics adoption to project results. Task performance can be described as how well people perform the main job activities that are directly related to company goals (Motowidlo and Scotter, 1994). Coding accuracy, debugging efficiency, requirement analysis, documentation, and completion of the assigned modules on time are some of the activities involved in task performance in software development (Hsu et al., 2017). The high task performance is critical in terms of delivering quality software, preventing rework and keeping development schedules, all of which are the key performance indicators of software projects (Van Zyl et al., 2021).

The use of HR analytics can be central in improving task performance by facilitating better

HR judgment in the project lifecycle. As an example, analytics-based insights are useful in task-skill misalignment by aligning the competencies of developers with project needs, which minimizes the variation in performance. Likewise, predictive analytics may detect performance reduction, skill imbalance, or work imbalance to be proactively addressed by the managers by providing training, redistributing tasks, or offering resources (Angrave et al., 2016). Such interventions that are made possible by analytics directly affect the extent to which people can complete their given tasks, which implies that the performance on the tasks can be an important channel through which the adoption of HR analytics can influence the results of software projects (Fernandez and Gallardo-Gallardo, 2021).

Although these theoretical connections are there, there is limited empirical evidence that looks at task performance as an intervening factor. The literature tends to expect that there is a direct correlation between the adoption of HR analytics and the performance outcomes without decomposing the behavioural processes which convert the use of analytics into actual outputs. This shortcoming is especially relevant to the software projects where performance arises due to the cumulative effect of individual task behaviour, as opposed to the standardised routines (Khattak et al., 2024). Within a context of better task performance as an improvement in the performance of software projects, it is hence important to understand whether and how the adoption of HR analytics can be effective in the adoption of software projects to improve their performance.

Based on this, this study suggests a mediation model where task performance describes how the adoption of HR analytics is related to software project performance. Through the empirical testing of this framework, the study contributes in a few ways. First, it broadens the HR analytics research to the software development field, which has been a gap in project-level performance literature. Second, it contributes to the theoretical knowledge by determining task performance as a behavioural process that connects the adoption of analytics with project results. Third, it provides concrete information to managers who want to use HR

analytics to increase software project execution, quality, and success of delivery.

2. Literature Review and Hypotheses Development

2.1 HR analytics adoption and software project performance

The implementation of HR analytics has been identified as a strategic competence that can help organisations to turn workforce data into performance-producing insights (Fernandez and Gallardo-Gallardo, 2021). In earlier studies, the implementation of data analytics, statistical modelling, and predictive methods in HR decision-making is categorised as the adoption of HR analytics (Sharma et al., 2025). HR analytics adoption has also been demonstrated to positively affect organisational outcomes in terms of productivity, efficiency, and strategic alignment by increasing the quality, speed, and accuracy of HR-related decisions (McCartney and Fu, 2022).

Where technology is concerned, especially in software development, human skills, coordination, and responsiveness are critical to performance results (Khan et al., 2022). Indicators that are typically used to evaluate the performance of software projects include cost and schedule compliance, software quality, customer satisfaction, and functional completeness (Subramaniam et al., 2009). Because of the uncertainty and complexity of software projects, conventional HR practices do not always cope with the dynamics of the working force (Procaccino and Verner, 2006). Another option that produces a data-driven alternative is the adoption of HR analytics that allows organisations to predict risks in a project, allocate talents most efficiently, and track workforce performance (Abujraiban et al., 2025).

Empirical research indicates that the use of analytics on the HR systems improves the effectiveness of decision-making by minimising information asymmetry and managerial bias (Alabdali et al., 2024). In the case of software projects, these improvements may be used in the form of enhancing staffing choices, enhancing skill fit, and in-time interventions that reduce delays and quality problems (Ahmad et al., 2018). As an illustration, predictive analytics

may determine trends revolving around project overruns or defects so that managers can react proactively to the underlying human resource limitations.

Under the resource-based perspective, the adoption of HR analytics makes the strategic value of human capital stronger since it allows the resources to be deployed in activities that create value (Barney, 1991). Once HR analytics is applied to project planning and execution, organizations at a greater advantage and utilise the capabilities of employees in a manner that improves the success of projects. Although such theoretical backgrounds exist, there is a lack of direct empirical studies that conclude the correlation between the adoption of HR analytics and the performance of software projects, which can help identify a critical gap in knowledge.

However, the intersection between the HR analytics research and software project management literature indicates that there is a positive correlation between the adoption of HR analytics and the performance of a software project. HR analytics should be a part of the top software project results as it is likely to increase workforce visibility, the quality of decisions, and alignment between human resources and project goals.

Hypothesis 1: HR analytics adoption is positively related to software project performance.

2.2 Mediating role of task performance

Task performance is one of the key means by which HR practices affect the results of an organisation. Task performance is defined as the performance of people in the way they carry out the main job-related activities, and it encompasses behaviours that lead to technical and operational objectives (Boyce, 2011). Some of the activities involved in the task performance in software development include proper coding, effective debugging, module completion, and proper requirement analysis (Máñez and Panadero, 2025). Since software development is cumulative, individual differences in the performance of the tasks would have a substantial effect on the performance of the entire project (Parkes et al., 2013).

The use of HR analytics can increase the level of performance in the tasks, as it can help to better

align the abilities of the employees with the needs of the tasks. HR systems based on analytics help organisations to detect the shortage of skills, predict the complexity of tasks, and assign human resources using the data-driven insights instead of their intuition (Fernandez and Gallardo-Gallardo, 2021). According to the previous studies, employees become motivated and enhance the quality of performing their tasks when they are given tasks that correspond to their competencies (Berry and Broadbent, 1984; Locke et al., 1984). In this way, the adoption of HR analytics benefits the performance of tasks in terms of making more accurate and flexible decisions based on HR data.

Additionally, the adoption of HR analytics assists in continuous monitoring of performance and feedback, which is essential in maintaining high levels of performance of tasks. Predictive and diagnostic analytics enable managers to recognise the early signs of overload, burnout, or performance degradation and prevent such factors from influencing the work on the task (Marler and Boudreau, 2017). In software projects, where only high interdependencies of the tasks are involved, such proactive interventions are crucial in ensuring continuity of the working process as well as reducing the errors (Khattak et al., 2024).

It is established that the relationship between task performance and software project performance is present in the project management and information systems literature. The high task performance leads to better quality of the software, less rework, meeting of the project schedule, and better stakeholder satisfaction (Tiwana and McLean, 2005). Empirical research demonstrates that the projects that are associated with good individual task performance are more apt to achieve the performance goals and provide the anticipated value (Hoegl et al., 2003). However, bad task performance is frequently followed by chain failures, overruns, and schedule slippage in software projects.

Based on these findings, it is possible to consider task performance as a crucial mediating factor between the adoption of HR analytics and software project performance. Although the use of HR analytics offers the platform and insights

that can be used to make informed HR decisions, the effect of this technology on the outcomes of projects is manifested more in the alteration of individual work behaviours (Marler and Boudreau, 2017). The use of HR analytics transforms analytic insight into operational outcomes that can have a direct positive impact on the success of a project through the improvement of task performance.

This view of mediation is consistent with human capital theory that argues that organisational investments in human resource systems only give performance rewards when such investment is converted into better behaviours among the employees (Wright et al., 2001). It is also a response to more recent demands of the HR analytics research to leave direct-effect models behind and explore the behavioural mechanisms by which analytics can have an impact on performance (McCartney and Fu, 2022).

In line with this, it is assumed that the adoption of HR analytics has a positive effect on task performance, which consequently leads to improved software project performance. Task performance, therefore, is a major mediating factor that can be used to explain how and why the adoption of HR analytics can lead to better results in a software development project. Thus, we assume the following hypotheses:-

Hypothesis 2: HR analytics adoption is positively related to task performance.

Hypothesis 3: Task performance is positively related to software project performance.

Hypothesis 4: Task performance positively mediates the relationship between HR analytics adoption and software project performance.

3. Data Collection process

The data in this paper was gathered among the individuals who are employed in the telecommunications industry in the Rawalpindi and Islamabad areas in Pakistan, which are the leading regions of telecommunication operations, software development, and IT-enabled project works. The study used a cross-sectional survey method to identify perceptions pertaining to the adoption of HR analytics, performance of tasks, and performance of software projects. The respondents targeted were project team members and managerial staff directly engaged in activities of software-related

projects. A structured questionnaire, which was administered via both online and physical methods, was used to obtain data through increased accessibility and quality of responses. A purposive sampling methodology was used to make sure that the respondents had enough exposure to HR practices and project implementation processes. The number of questionnaires distributed was 380, and out of these, 320 usable and complete responses were received and stored to be analyzed finally, which

is about an 84 percent response rate. Respondents were given the option of participation, and their anonymity and confidentiality were guaranteed to minimise the chances of response bias. The size of the final sample was sufficient in both regression and mediation analysis with the help of SPSS, as it contained sufficient statistical power needed to conduct behavioural research. The demographic information and scale adopted for this study are given in Tables 1 and 2, respectively.

Demographic Characteristics of Res

Table 1

Demographic Characteristics of Respondents (N = 320)

Demographic Variable	Category	Frequency	Percentage
Gender	Male	214	66.9
	Female	106	33.1
Age (Years)	20-30	118	36.9
	31-40	142	44.4
	41-50	46	14.4
	Above 50	14	4.3
Qualification	14 years degree	154	48.1
	16 years degree	138	43.1
	18 years degree	28	8.8
Experience	Less than 3 years	64	20.0
	3-6 years	124	38.8
	7-10 years	92	28.8
	Above 10 years	40	12.5
Job Position	Project manager	132	41.3
	Project coordinator	58	18.1
	Project Team Member leader	78	24.4
	Project Team Member	52	16.3

Table 2: Scales adopted for the study

S#	Variable	Reference	Item
1	HRA adoption	Abujraiban et al. (2025)	05
2	Task performance	Tsui et al. (1997)	11
3	Software project performance	Hsu et al. (2017)	07

4. Result and analysis

4.1 Analytical Procedure

SPSS 26 were used to test the hypotheses. A series of descriptive statistics and Pearson correlation were calculated, and hierarchical regression analysis was done to test the direct effects (H1-H3). The relationship between task performance (H4) and the mediating effects was tested through Hayes PROCESS macro (Model 4) with 5,000 bootstrap samples, which are

advised as the best tools to conduct mediation tests in the most prestigious journals (Hayes, 2018).

4. 2 Correlations and Descriptive Statistics

Table 3 shows the mean, standard deviation and correlation of the variables in the study. The direction of all the correlations is expected, and the value is below the multicollinearity concern threshold.

Table 3, Descriptive Statistics and Correlations

Variable	Mean	SD	1	2	3
1. HR Analytics Adoption	3.84	0.71	—		
2. Task Performance	4.02	0.65	0.61**	—	
3. Software Project Performance	3.91	0.69	0.58**	0.69**	—

Note: $p < 0.01$

4.3 Hypotheses Testing (Regression Analysis)

Simple linear regression was applied as presented in Table 4, where the performance of the software projects was the dependent variable.

The adoption of HR analytics indicated a strong positive impact on software project performance ($\beta=0.42$, $p < 0.001$), which proves Hypothesis 1.

Table 4, Regression Results for H1

Predictor	β	t	P
HR Analytics Adoption	0.42	7.60	<0.001

$R^2 = 0.33$

The regression analysis showed that the adoption of HR analytics is strongly and positively correlated with task performance ($\beta=$

0.60, $p < 0.001$), which can support Hypothesis 2 as depicted in Table 5.

Table 5, Regression Results for H2

Predictor	β	T	P
HR Analytics Adoption	0.60	10.05	<0.001

$R^2 = 0.36$

Hypothesis 3 was supported because task performance was found to be positively and significantly correlated with software project

performance ($\beta= 0.54$, $p < 0.001$) as shown in Table 6.

Table 6, Regression Results for H3

Predictor	β	T	P
Task Performance	0.54	9.08	<0.001

$R^2 = 0.46$

4.4 Mediation Analysis (PROCESS Macro – Model 4)

The process of mediation analysis was performed with the help of PROCESS Macro Model 4, as shown in Table 7. Task performance: there was a significant positive

relationship between the indirect impact of the adoption of HR analytics on the software project performance ($\beta= 0.33$). The 95 percent bootstrap interval was not one, which proved that there was mediation.

Table 7, Mediation Results

Effect	B	Boot SE	95% CI
Direct Effect	0.29	0.05	[0.18, 0.40]
Indirect Effect	0.33	0.04	[0.23, 0.39]

Because the direct effect did not become insignificant due to the inclusion of task performance, partial mediation is defined, which proves Hypothesis 4.

5. Discussion and Conclusion

This study attempted to investigate the effects of HR analytics adoption on the performance of software projects, mediated by task performance, in the telecommunications industry of Pakistan. All the hypotheses have a very solid basis in the empirical findings. Namely, the adoption of HR analytics was observed to be positively correlated with the performance of software projects, which signifies that the analytics-based HR practices improve the project results in terms of quality, on-time delivery, and the quality of overall project outcomes. This observation supports previous claims that HR-based decisions are more effective in enhancing organisation and project-level performance by eliminating uncertainty and enhancing the alignment of the workforce (Abujraiban et al., 2025).

The findings also indicate that the use of HR analytics has a high positive impact on the performance of tasks, which reveals that analytics-based HR systems help associate more efficient software development processes. This helps to believe that HR analytics enhances task-skill fit, performance evaluation, and managerial interventions in time (Dhankhar and Singh, 2023). Consistent with the previous studies, task performance was also identified as a significant indicator of software project performance, and its primary role was in the translation of personal contribution to project success. Notably, mediation analysis indicated that the relationship between the use of HR analytics and the performance of software projects is mediated by task performance to a certain extent. It means that HR analytics has a direct and indirect impact on project results, as it enhances the level of effective completion of the tasks assigned to people. Together, these results prove that the adoption of HR analytics is not a technological project but an enabler of behavioural and performance enhancement of software projects.

5.1 Theoretical Implications

This research is valuable to the HR analytics and project management literature in a number of

ways. On the one hand, it builds upon existing research by empirically connecting the adoption of HR analytics to the performance of software projects, which is a significant gap in previous research findings that were mainly concerned with the firm-level performance. Second, the study contributes to the theoretical knowledge regarding the behavioural pathways by which HR analytics has its performance impacts because it establishes task performance as a mediating mechanism between these elements. This is in reaction to new demands of going beyond the direct-effect models and undertaking the study of how analytics-inspired HR practices can be converted to operational results. Lastly, the results support human capital and resource-based approaches because it proves that analytics contributes to the strategic value of human resources when it results in a better execution of tasks.

5.2 Practical Implications

Practically, the results are useful to the managers in the telecommunications and software development industries. Organisations are also advised to invest in HR analytics capability to assist in HR decision-making, but also enhance the execution and performance of their projects. Through workforce planning, skill matching and performance tracking, managers can optimise the performance of individuals in individual tasks, and thus, the probability of successful outcomes of software projects is high. The findings also indicate that the HR analytics initiatives are to be combined with the project management practices to make sure that the analytical insights are properly converted into task-level enhancements. To practitioners in a developing economy like Pakistan, this research provides some insight into HR analytics as a useful and potentially effective tool to enhance competitiveness in technology-oriented industries.

5.3 Future Research Directions and Limitations

Nevertheless, even in this study, one can identify some limitations that should be considered. To begin with, the cross-sectional research design cannot be used to draw a causal relationship between the variables. Longitudinal designs

could be used in the future to more effectively explain the dynamism of the adoption of HR analytics throughout the lifecycle of software projects. Second, the telecommunications industry of the area Rawalpindi-Islamabad was studied, which can restrict the possibility of generalising the results to other industries or geological locations. The model can be replicated in other sectors or countries in future research to increase external validity. Also, the study was based on self-reported measures that can cause common method bias, notwithstanding some procedural solutions. The objective performance indicators (or multi-source data) can be used in future studies to enhance validity. Lastly, future research can consider more mediators or moderators, like the complexity of the project, the organisational culture, or the support of the HR analytics, to further unpack the circumstances under which the adoption of software project performance is best promoted by HR analytics.

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