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ARTICLES

CLUSTERING MEMBERS OF PROJECT TEAMS ACCORDING THEIR PERCEPTIONS ABOUT THE IMPACT OF REMOTE WORK ON PROJECT SUCCESS: A COMPARATIVE ANALYSIS

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ABSTRACT. This study aims to analyze the experiences of individuals involved in a project that had to quickly transition to remote work during the COVID-19 pandemic. Data were collected in late 2020, a period when remote work was intensive, and effective drugs and vaccines against SARS-CoV-2 virus were not yet available. To collect the data, a link to a questionnaire was made available in project management groups on social networks. Out of a total of 162 voluntary respondents, data from duplicate records and those who were not involved in the project during the pandemic were excluded, resulting in 134 valid responses. The focus was on the perception of remote work in relation to project success criteria and respondent profiles. Data analysis was conducted using an ordered classification method, utilizing Likert frequency counts, data segmentation, and the k-modes clustering method, supported by the R programming language. The findings indicate that remote work has a positive influence on project performance. However, the impact varies across different respondent profiles. Data segmentation suggests that male participants, unmarried respondents, individuals without children or elderly dependents, those without a dedicated workspace, and project managers (when compared to team members) perceive remote work to have a less favorable impact on project success. In the cluster analysis using k-modes, data was organized into two clusters, and it was observed that within Cluster 2, which had a comparatively lower perceived performance, there were more components with similar profiles highlighted in the data segmentation analysis. This suggests that the multi-factorial effect is consistent with the individual segmentation of each profile variable. These insightful findings have significant implications for the development of tailored project continuity plans, particularly in situations requiring a swift transition to remote work. The study's main contribution lies in its innovative approach to distinguish between participant profiles, providing valuable insights into various criteria for project success.

Keywords: project management, success criteria, clustering, work from home, K-modes.

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1 INTRODUCTION

According to Heng et al. (2012) the rapid transition from on-site work to remote work has been frequently adopted to ensure business and project continuity in emergency situations, such as during disasters.

During outbreaks of communicable diseases, remote work has also been employed as a preventive measure. However, in recent history, no event compares to the isolation imposed by the SARS-CoV-2 virus pandemic (Buomprisco et al., 2021; Kashive et al., 2021; Liebermann et al., 2021; Patanjali & Bhatta, 2022).

The SARS-CoV-2 coronavirus pandemic began in late 2019 in Wuhan, the capital of Hubei province, China, and spread to other regions of the world in the first quarter of 2020. This rapid spread required the immediate adoption of social distancing measures to prevent the accelerated transmission of the virus and the overload of healthcare systems (Belzunegui-Eraso & Erro-Garcés, 2020; Kashive et al., 2021; Shereen et al., 2020).

Despite the pre-pandemic growth of teleworking, which is considered a measure resulting in increased productivity, employee retention, organizational commitment, and organizational performance (Martin & MacDonnell, 2012), the abrupt migration to this work model involved an unplanned adoption for many. This unforeseen circumstance may have had a potential negative impact on project performance.

It is important to note that the overall context of the pandemic was negative, including the psychological impact of quarantine and social isolation on individuals, which could have affected project performance to varying degrees depending on individual circumstances (Brooks et al., 2020).

In this regard, this study aimed to evaluate the impact of remote work on project performance among different profiles of project participants and leaders during the pandemic. As project success is measured using multi-factorial approaches (Albert et al., 2017; Borges & De Carvalho, 2015; Varajão et al., 2022), the influence of teleworking on various success criteria collected from the literature was also assessed.

By acknowledging disparities among participants concerning each dimension of project success, it becomes feasible to devise tailored responses for each subgroup. This approach instills rationality in management actions, as group members tend to seek commonalities among themselves and distinctions from alternative groups. Consequently, in the event of recurrences, attributable to various potential factors, opportunities for learning can be capitalized upon. Subsequently, project continuity plans can be formulated while considering these profile differences, enabling the seamless implementation of teleworking with the preservation of project performance.

Several recent studies have employed K-modes clustering to cluster datasets characterized by categorical attributes, subsequently suggesting recommendations or actions tailored to each cluster.(De Lorena & Costa, 2023; Chu et al., 2023; Tan & Mehta, 2022; Tolner et al., 2021; Banerjee et al., 2021).

Indeed, the K-modes method is specifically designed for the examination of respondent profiles defined by categorical data and sets itself apart from other clustering algorithms.(Zafar & Swarupa Rani, 2021).

The main objective was to to analyze the experiences of individuals who were involved in a project and had to make a rapid transition to remote working due to the COVID-19 pandemic.

Our initial hypothesis posits that the success of the project could be influenced by social predictors such as ”gender,” ”marital status,” and ”responsibilities towards the elderly and children.”

It is important to consider that during the analyzed period, schools and kindergartens were not operational(Pontarolo et al., 2023), the elderly population was at a higher risk, and vaccines and medicines were not readily available.

It is plausible that various combinations of profile characteristics could affect the perception of the project's success among those involved.

Other assumptions pertained to infrastructure factors, including ”internet access” and ”shared workplace facilities.” Finally, we anticipated that project managers might experience more stress compared to project team members.Consequently, we examined the roles within the project.

To support the investigation of such hypotheses, thereby achieving the central objective of enhancing continuity plans in future situations, we formulated the following subsidiary questions:

- Q1: What are the project success criteria adopted in academic literature?
- Q2: What is the perceived influence of telecommuting in overall project success?
- Q3: Was there variation in perceived influence between project success criteria?
- Q4: Was there variation in influence between participants due to social predictors?
- Q5: What is the relationship between the identified criteria and the overall project success assessment?
- Q6: What If we apply clustering technique on data influencing project performance, what is the performance and profile of the cluster components?

The subsequent sections will present the theoretical foundations, the methodology employed, the analysis of the findings, and the concluding remarks.

2 THEORETICAL BACKGROUND

Two concepts relevant to the development of this work are presented below, telecommuting and k-modes clustering.

2.1 Telecommute

Remote work, work-from-home, work-from-anywhere, and telecommute are some of the terms used to refer to the migration from the traditional social organization of work, where employees have a specific place for carrying out activities, to the modern possibility of working outside a centralized workplace (Green et al., 2020; Liebermann et al., 2021; Martin & MacDonnell, 2012; Pirzadeh & Lingard, 2021).

The emergence of telecommute is attributed to the work of an American scientist named Jack Nilles (Nilles, 1975), who proposed the use of telephone lines and computers to divert some work from traditional offices, thus promoting a reduction in urban traffic. He became known as the ”Father of telecommute” (Pirzadeh & Lingard, 2021). Since then, many transformations in these models have been experienced, and special conditions, such as the pandemic, have forced the unplanned adoption of remote work.

Because of its extremely infectious nature, the COVID-19 pandemic caused extensive social isolation and a considerable increase in telecommute. Health authorities enacted social distancing measures, resulting in school closures, workplace closures, and travel restrictions, making remote work a critical tool for business continuity and virus exposure minimizationSalon et al. (2022); Mendrika et al. (2021).

2.2 K-modes Clustering

Clustering systems are widely used to identify groups of elements with similar characteristics and significant differences from other groups. These methods form the basis of computational intelligence and have been developed since the pioneering works of Steinhaus (1956), Ball & Hall (1965), MacQueen (1967), and Lloyd (1982), who developed and improved the k-means algorithm. This algorithm uses the centroid, which is composed of the means of the coordinates of the elements, to represent the group of elements based on the Euclidean distance from the elements to the centroid.

There are other algorithms considered as extensions or derivatives of K-means to handle specific data characteristics or desired applications. For instance, there is the K-medoid algorithm, which, in determining the cluster center, uses actual data points as representatives of the clusters, referred to as ’medoids,’ thus giving rise to the name ’K-medoid.’ This approach differs from K-means, which calculates cluster centers using mean centroids(Kaufman & Rousseeuw, 2009).

Another algorithm is K-modes which is designed specifically for dealing with categorical data, such as Likert scales(Likert et al., 1934). The K-modes algorithm employs often used when are involved categorical data. It uses a dissimilarity metric based on mode (instead of means, for continuous data using k-means) and may effectively group data based on similar response categories, allowing for more appropriate clustering for this type of data(Kaufman & Rousseeuw, 2009).

In search of a more suitable tool for this type of data, the k-modes method was developed, which seeks a representative of the group through the mode. In this case, the mode of each coordinate represents the components of the group. The iterative K-modes algorithm executes procedures to identify elements with the lowest dissimilarity to the mode members of their respective groups, thereby determining the medoid, which serves as the representative center of the group that attains the minimum dissimilarity with its set of constituents(Kaufman & Rousseeuw, 2009; Huang, 1998). Dissimilarity is a metric used to quantify the distinction or separation between two data entities. Gower distance(Gower, 1975), on the other hand, is a standardized metric that ranges from 0 (indicating maximum similarity) to 1 (indicating maximum dissimilarity)(Hennig, 2010; Huang et al., 2013)."

3 METHODS

To achieve the objectives of this study, particularly at the appropriate time, which was during the pandemic and remote work emergency, we initiated by exploring the specialized literature that investigates the most relevant criteria used to evaluate project success. In addition to the collected attributes, we incorporated some that, based on our previous experience in project management, we believed could also affect the project during this pandemic period.

Based on the literature and researchers' experience, a data collection instrument was constructed and presented to a small group of respondents to evaluate its form. In this evaluation, the volunteers also provided criticism and suggestions regarding the clarity of the questions and alternatives that comprised the form. After collecting this feedback, improvements were made to the questionnaire before it was exposed to the research's target audience.

After prospecting social media channels populated by project professionals to display the form and invite voluntary participation in the survey, data collection was conducted between October 2020 and April 2021.

The collected data underwent analysis using the statistical software R, specifically version 4.1.3. Essential statistical packages, notably the Likert package (Jason Bryer, 2016) version 1.3.5, were employed.

The graphical representation of the procedures is depicted in Fig. 1.

3.1 Bibliographic survey

The success of the project is widely discussed in the literature, although this topic is still exhaustive. A literature review was conducted in Scopus and Web of Science (WoS) to identify criteria that influence project success; following Rodriguez (Rodriguez et al., 2013), this choice avoids the use of non-peer-reviewed articles and reduces the likelihood of considering "grey literature" (Rothstein & Hopewell, 2009). or predatory sources.

A search in the literature for the most recent criteria for project success was carried out. The search was conducted using the databases Scopus and Web of Sciences (Wos). The search term

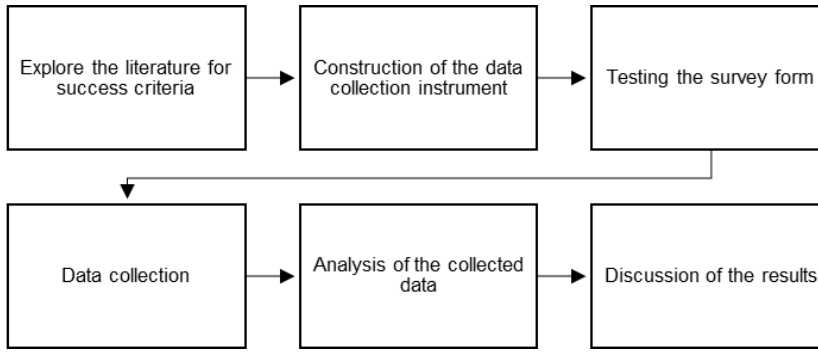


Figure 1 – Procedure used for this study.

used in the Scopus database was (TITLE-ABS-KEY (”project management”) AND TITLE-ABS-KEY (”success criteria”)).

In the base Web of Science, we used the terms ”project management” AND ”success criteria” (Title) or ”project management” AND ”success criteria” (Abstract) or ”project management” AND ”success criteria” (Author’s keyword).

As a consequence of this investigation, Table 1 was created, in which the following recurring criteria were identified in the analyzed articles, along with a brief description and corresponding references.

Such criteria were gathered in order to support a list of variables for measuring project success in various aspects. Despite the fact that the subjectivity involved is acknowledged, even in each criterion specifically evaluated.

3.2 Design of the data collection instrument

The questionnaire was designed so that participants could indicate the degree of influence of remote work on the project success criterion according to the following scale: (1) very negative influence, (2) negative influence, (3) neutral influence, (4) positive influence, (5) very positive influence.

Before making the form available to the public, it was tested with 5 selected respondents with varying degrees of familiarity with project management and computerized tools. After answering the questionnaire, they were asked to suggest improvements in the question formulation or alternatives and provide feedback on possible ambiguities or inaccuracies in the terms used. After incorporating the improvement suggestions, the final form was prepared.

The questionnaire was created using the Google Forms platform, and the link to the form was disseminated through social media, specifically project management groups on Facebook® and LinkedIn® on November 4, 2020. It was open to receive contributions through the address: https://forms.gle/M8sm2nicg9Sz3TFV7 until December 5, 2020, a period when many workers were in remote mode due to the SAR-COV-2 Coronavirus pandemic and the absence of control measures

Table 1 – Project success criteria.

Criterion	Brief Description	References
Time	The project is completed within the initially specified time-schedule	De Wit (1988); Pinto & Prescott (1988); Shenhar et al. (1997)
Costs	Does not exceed the established budgetary limits	Pinto & Prescott (1988); Shenhar et al. (1997); De Wit (1988); Baccarini (1999); Jugdev & Müller (2005); Andersen et al. (2006); Abdul et al. (2010); Serrador & Turner (2015); Albert et al. (2017); Koops et al. (2017); Pollack et al. (2018)
Scope	Achieved within the defined scope, technical performance, and expected quality, according to prescribed requirements and implicit expectations	Pinto & Prescott (1988); Shenhar et al. (1997); De Wit (1988); Atkinson (1999); Jugdev & Müller (2005); bin Abdullah et al. (2010); Serrador & Turner (2015); Albert et al. (2017); Koops et al. (2017); Pollack et al. (2018)
Efficiency	Resources were applied in a rational manner	De Wit (1988); Atkinson (1999); Baccarini (1999); Jugdev & Müller (2005); Andersen et al. (2006); Serrador & Turner (2015)
Mission/Purpose	The project outcome fulfills the intended purpose and motivates project accomplishment	Pinto & Prescott (1988); Shenhar et al. (1997); Atkinson (1999); Baccarini (1999); Jugdev & Müller (2005); Andersen et al. (2006); Serrador & Turner (2015); Albert et al. (2017); Montes-Guerra et al. (2015)
Organizational Benefits	Strategically contributes to organizational objectives	De Wit (1988); Atkinson (1999); Baccarini (1999); Jugdev & Müller (2005); Andersen et al. (2006); Serrador & Turner (2015)
Future Preparedness	Creates conditions for institutional development	Shenhar et al. (1997); Serrador & Turner (2015)
Stakeholder Satisfaction	Meets the expectations of stakeholders, including sponsor, end-user, project team, suppliers, etc.	Pinto & Prescott (1988); Shenhar et al. (1997); De Wit (1988); Atkinson (1999); Baccarini (1999); Jugdev & Müller (2005); Andersen et al. (2006); Serrador & Turner (2015); Albert et al. (2017); Koops et al. (2017)
Political and Social Impacts	Addresses political and social expectations	Montes-Guerra et al. (2015); Koops et al. (2017)
Legality and Compliance	Carried out in accordance with governance rules and requirements	Montes-Guerra et al. (2015); Koops et al. (2017)
Safety	Performed with safety measures and provides user safety	Koops et al. (2017); Acheamfour et al. (2019)
Sustainability	Positively impacts the environment, society, and finances	Koops et al. (2017); Acheamfour et al. (2019); Khalifeh et al. (2020); Mansell et al. (2020)

such as vaccines and effective medications.Data collection took place during a limited time-frame as some regions began vaccinating high-risk groups and easing restrictive measures. Therefore, we conducted data collection using a convenience sampling approach, where a participant who fit the expected survey profile was asked to refer other respondents who had been involved in remote projects during this period.

4 RESULTS

A total of 162 responses were obtained, after excluding duplicate contributions (due to form failures), resulting in 145 responses. We also identified 11 participants who were not involved in projects during the pandemic period and removed their contributions. This data arrangement resulted in a total of 134 observations.

4.1 Perceived influence in overall project success

Overall data analysis was performed, including the ranking of evaluated aspects (criteria), the heat map of the provided responses, correspondence analysis (Polychoric matrix), data segmentation by demographics, and clustering using the k-modes algorithm.

The Fig. 2 shows the influence of telecommuting on the overall success of the project in the perception of the respondents.

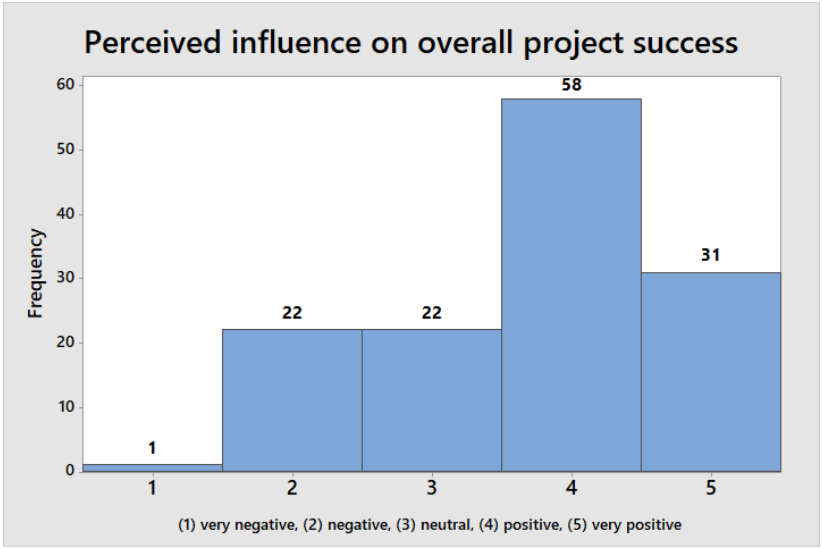


Figure 2 – Perceived influence of telecommuting on overall project success.

Most of respondents(65.9%) indicated that telecommuting positively influenced the overall performance of the projects they participated in this period.

Another graph illustrating these preliminary results is shown in Fig. 3, which employs a heat map to visualize the concentration of responses for each alternative and criterion.

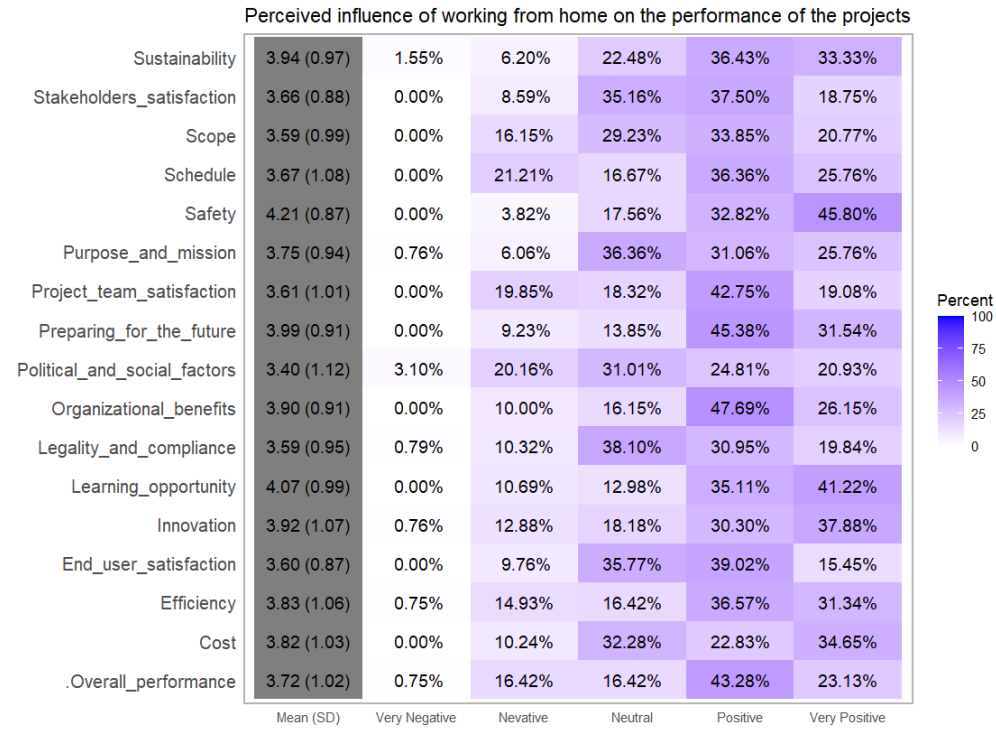


Figure 3 – Heat-map of the influence perceived by respondents of telecommuting on the success of the project.

4.2 Perceived influence between project success criteria

The questionnaire responses were processed by the statistical software R using the likert package (Jason Bryer, 2016). The graph generated by the ”likert” package’s plot() function that is a visual representation of Likert scale data. It helps visualize the distribution of participants’ responses across the scale categories.

The graph consists of a series of bars representing the Likert scale categories along the y-axis, while the x-axis represents the count or proportion of responses in each category.

The bars are divided into segments, where each segment represents a specific response. In our paper (1) very negative influence, (2) negative influence, (3) neutral influence, (4) positive influence, (5) very positive influence. The length of the segment within the bar indicates the percentage of responses in that specific category. Additionally, the bars are split into colored parts to indicate the direction of divergence from a reference response - in our case (3) neutral influence - so that, The categories received different colors. At the negative side of the , the answers , (1) very negative influence are shown with color dark red and (2) negative influence in light red, in the other hand, the categories (4) positive influence use light green, and (5) very positive influence, dark green.

The compared questions are shown in the decreasing ordination of balancing (4) and (5) in comparison of (1) and (2). The result of our analysis are displayed in Figure 4.

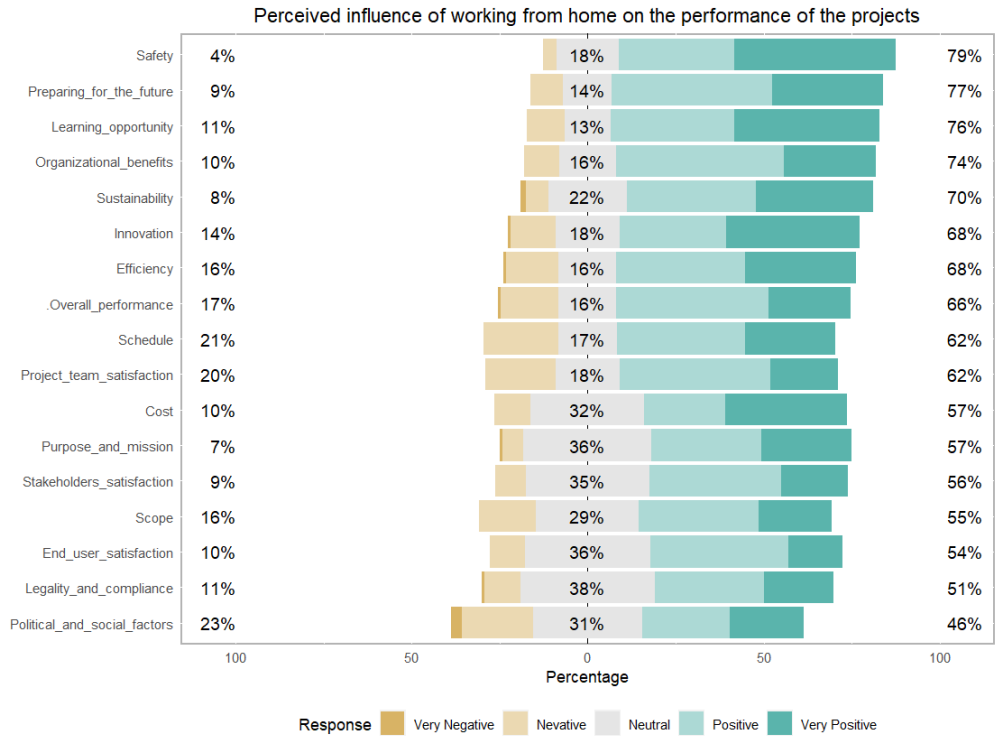


Figure 4 – Ranking of the respondents' perceived influence of telecommuting on individual success criteria.

It can be noticed that "Overall performance" was influenced negatively or very negatively by 19% of respondents, neutrally by 16%, and positively or very positively influenced by 65% of survey participants.

Among the 16 criteria presented, "learning opportunity" obtained the best evaluation, with 80% positive or very positive influence evaluations, and "attention to political and social factors" got the most negative evaluation, with 12% negative or very negative evaluations, 36% neutral, and 52% positive or very positive evaluations.

It is worth noting that in all cases, less than 2% of respondents chose the alternative (1) "very negative" influence. The (3) "neutral" ratings ranged from 12.98% in terms of learning opportunity to 36.59% in terms of "cost." The (5) "very positive" evaluation only received 13.95% for "end user satisfaction," 45.86% for "project team satisfaction," and 45.86% for "legality and compliance." However, none of the respondents indicated (1) a very negative influence for 9 of the 16 criteria, namely "stakeholder satisfaction", "scope", "performed safely", "project team

satisfaction", "future readiness", "organizational benefits", "legality and compliance", "end user satisfaction", "learning opportunity", and "costs".

4.3 Data analysis segmented by respondent profile

Brazil had the highest participation rate in projects, with 101(75.4%), followed by the United States with 13(9.7%), Germany with 9(6.7%), and other countries with 11(8.2%). It is also worth noting that only 24 (17.9%) of these respondents worked remotely before the pandemic.

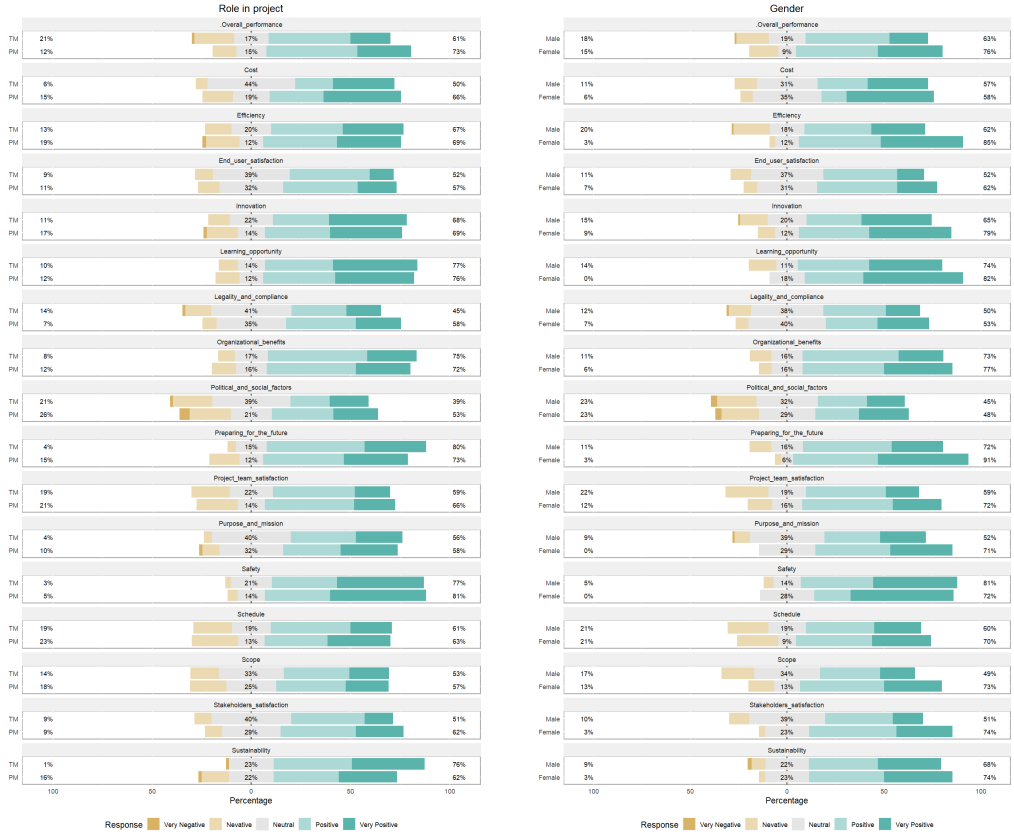
Respondent profiles were assessed based on their project role, gender, marital status, parental responsibility of children or the elderly, and workplace usage. Table 2 shows the number of respondents and percentages for each profile variant.

Table 2 – Respondents Profiles.

Profile	Respondents(n)	Percentage
Role played in the project		
Project manager	60	44.8%
Team member	74	55.2%
Gender		
Female	33	24.6%
Male	101	75.4%
Marital Status		
Single	102	76.1%
Married	24	17.9%
Divorced	8	6.0%
Responsible for children or elderly		
Yes	73	54.5%
No	61	45.5%
Workplace use		
Exclusive	87	64.9%
Shared	47	35.1%
Adequate Internet		
Yes	121	90.3%
No	13	9.7%

The likert package of R (Jason Bryer, 2016) was used to perform the comparative analysis, where for each variable a neutral(3) response is centered and summed positive (4) and very positive(5) influence responses on the right and negative(2) and very negative(1) responses on the left.

The results are show in Figure 5 wich shows the segmentation by profile, considering variables: "Role in project team" and "Gender of respondent" , Figure 6 that shows the segmentation by profile, considering variables: "Marital Status" and "Responsibility for elderly or children". , and Figure 7 that depict the segmented Results by "Workplace Sharing" and "Quality of Internet".

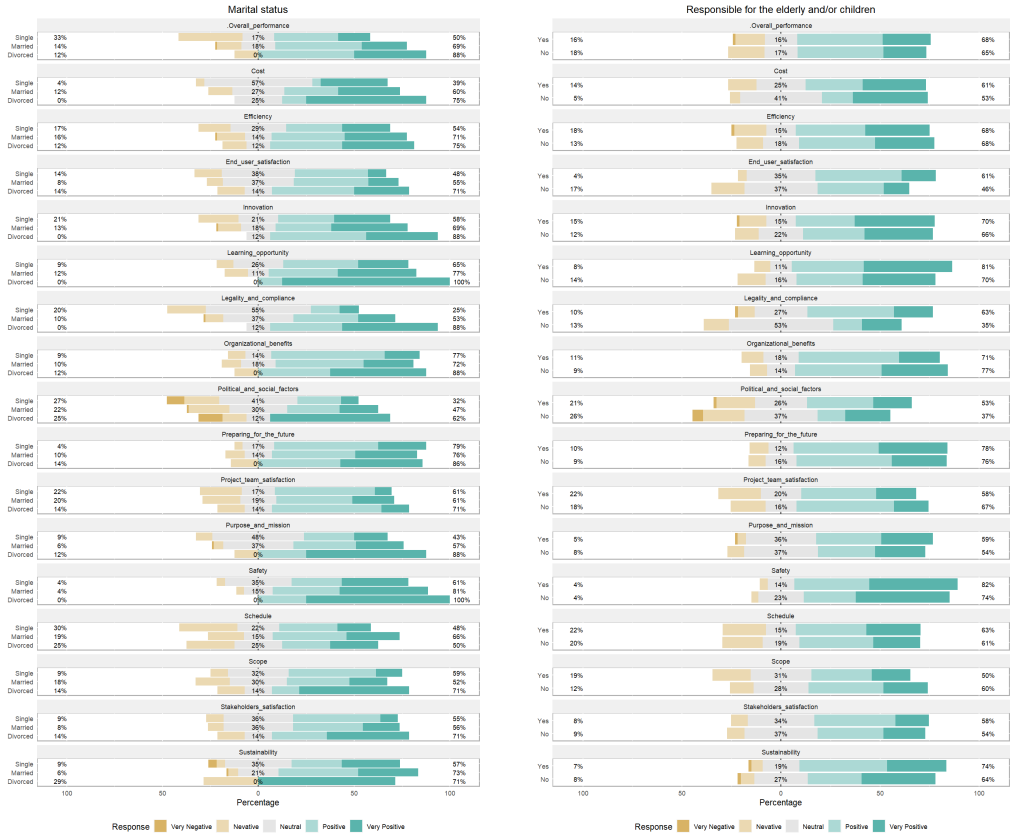


(a) Role in project team

(b) Gender of respondent

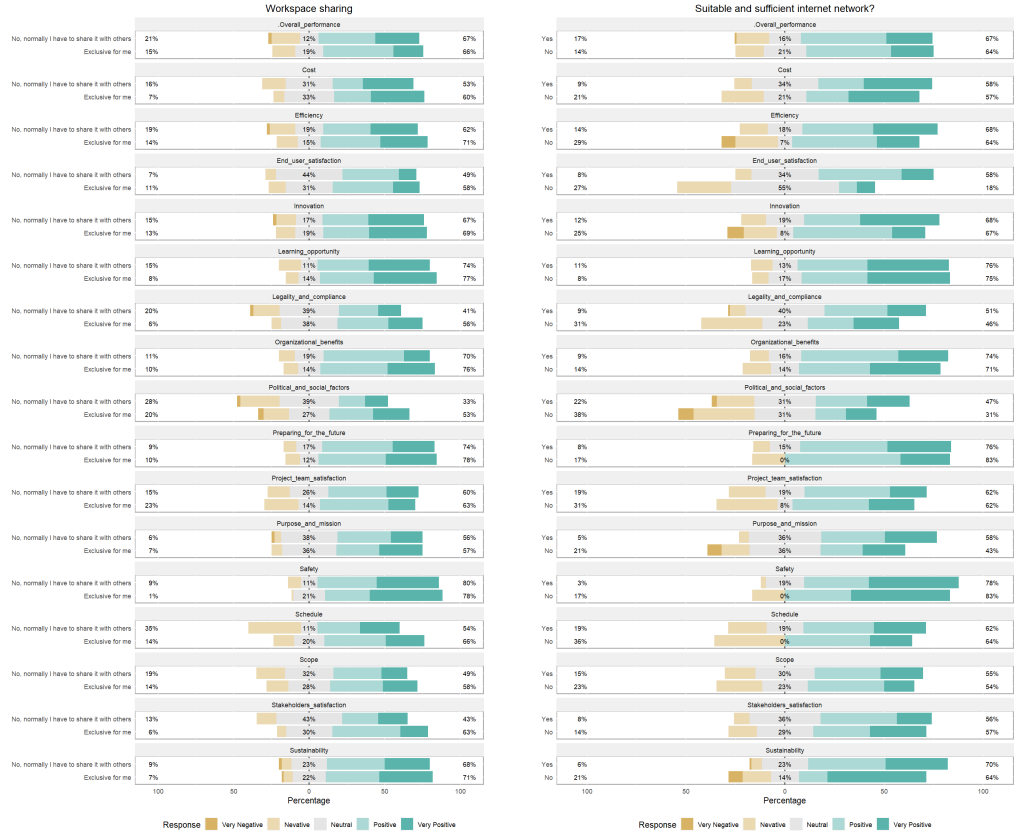
Figure 5 – Segmentation by profile - Role in project team / Gender of respondent.

The results presented in Figure 5a indicate that the respondents' performance varied according to the different criteria. Figure 5b reveals that female respondents reported a greater positive influence of remote work compared to male respondents. Except for a few criteria, respondents with care-giving responsibilities for the elderly or children had a more positive influence on remote work, as shown in Figure 6a. In Figure 6b, married or divorced participants scored higher on 11 of the 16 criteria than single participants. Finally, Figure 7a shows that respondents who had an exclusive workspace outperformed those who had to share the workspace with others, whereas Figure 7b shows that the quality of the available internet influenced project performance.



(a) Marital Status **(b)** Responsibility for elderly or children

Figure 6 – Segmentation by profile - Marital Status/Responsibility for elderly or children.



(a) Workplace Sharing **(b)** Quality of Internet

Figure 7 – Segmentation by profile - Workplace Sharing / Quality of Internet.

4.4 Relationship between criteria and overall success

A polychoric correspondence matrix is used to understand how ordinal categorical variables relate to or influence one another. It facilitates in the detection of noteworthy patterns and provides insights into the relationships between the variables under examination.

The index for the polychoric correlation matrix is calculated by utilizing statistical association measures that take into account the ordinal character of the category variables under consideration.

The Polychoric Contingency Coefficient (PCC) is a statistical measure used to assess the strength of relationships between ordinal categorical variables. It has a value between 0 and 1, and it is as follows:

- 0 (null) indicates that there is no correlation between the variables
- 1 (one) represents a perfect association between the variables.

With the purpose of investigating the relationship between the identified criteria and the overall project success assessment another analysis was carried out using the Polychoric correlation matrix between individual success criteria and global success, with the results shown in Fig. 8.

The following individual criteria had the highest correspondence indices with Overall Success: Efficiency (0.78), Purpose and mission (0.68), Scope, stakeholders and project team satisfaction (0.62), Schedule (0.61) and Organizational benefits (0.55). The lowest indices Learning Opportunity (0.32) and Sustainability (0.38).

Figure 8 – Polychoric correlation between success criteria and global success.

4.5 Data clustering and Respondent profiles

The k-modes clustering method (Huang, 1998), which is suitable for leading with categorical data, was used to observe clusters with similar evaluation. We utilized the radar chart to mark the coordinates of the medoids for each cluster, which is representative of its cluster due to having the lowest dissimilarity, as per the method's objective. Thus, we can analyze the cluster through its best representative, a virtual medoid component that has the modes for each variable from the assessments of the components within that cluster. The cluster number k=2 was determined using the Silhouette method (Rousseeuw, 1987). The illustration depicting the comparison between clusters is presented in Figure 9.

In Figure 9, where the modes are represented as radar plots, a significant difference between the clusters is evident. However, in Figure 10, which presents the ordering using the likert package for each criterion grouped by cluster, it can be observed that the mode, which provided the modeoid, fails to convey all the information that the likert graph enables. Despite likert graphs being the recommended method, there is a suspicion that k-means clustering for this type of analysis may be more comprehensive in comparing categories. This is because the mean, which indicates the centroids of the clusters, preserves more information from the dataset that composes

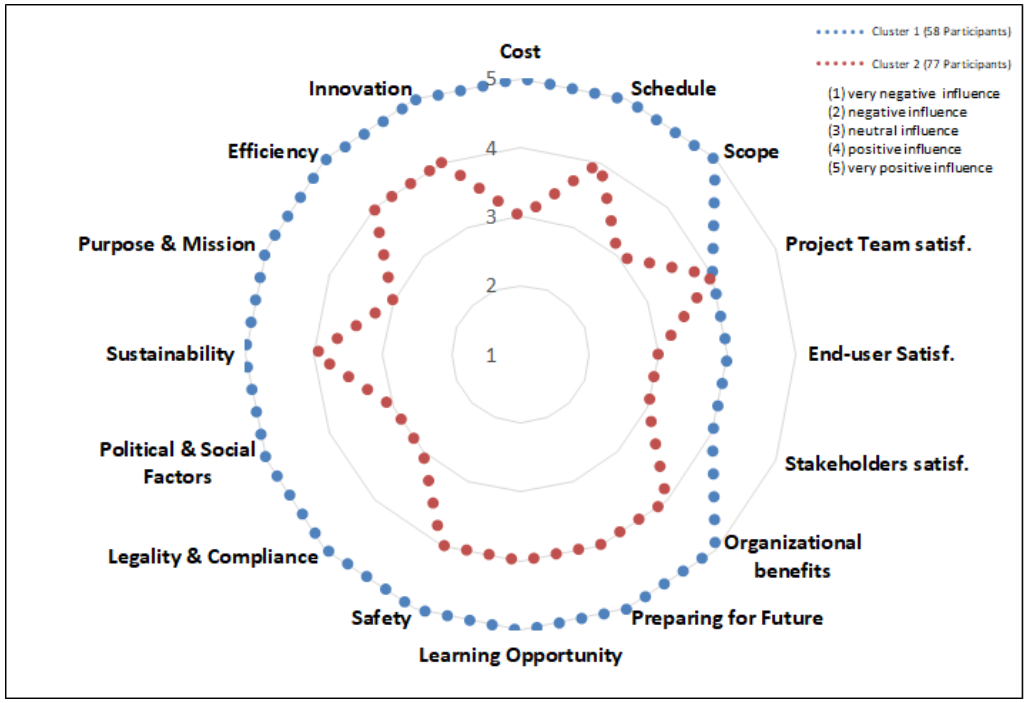


Figure 9 – Radar Plot: Variables of Medoide of each cluster.

such clusters. The successful utilization of these methods can be seen in previous studies such as De Souza & Costa (2021); De Souza et al. (2022b, 2023, 2022c).

But, it is possible to notice a difference between the groups, where the answers of cluster 1 outnumber those of cluster 2 in all criteria. Thus, we sought to compare what would be the profile of the respondents in each cluster. Table 3 shows the predominant respondent profile in each cluster.

It was possible to verify that the profiles that in the segmented Likert chart showed the best influence of remote work on project performance, were more present in cluster 1.

In the consolidated table, which presents a comprehensive overview of respondent characteristics and their corresponding clusters, we can observe the following trends. The categorization by respondents' roles in projects shows that Cluster 1 has a slightly higher proportion of project participants compared to project managers. When examining the distribution of gender within each cluster, it becomes apparent that Cluster 1 has a higher proportion of females, particularly those with a more positive perception of telecommuting in projects. Analyzing the data based on marital status, we find a significant predominance of unmarried individuals in Cluster 2, which represents respondents with a more negative perception of remote work. The segmentation by responsibility for children or the elderly indicates a slightly higher proportion of individuals in Cluster 1 who bear this responsibility. Notably, Cluster 1 is characterized by a greater presence

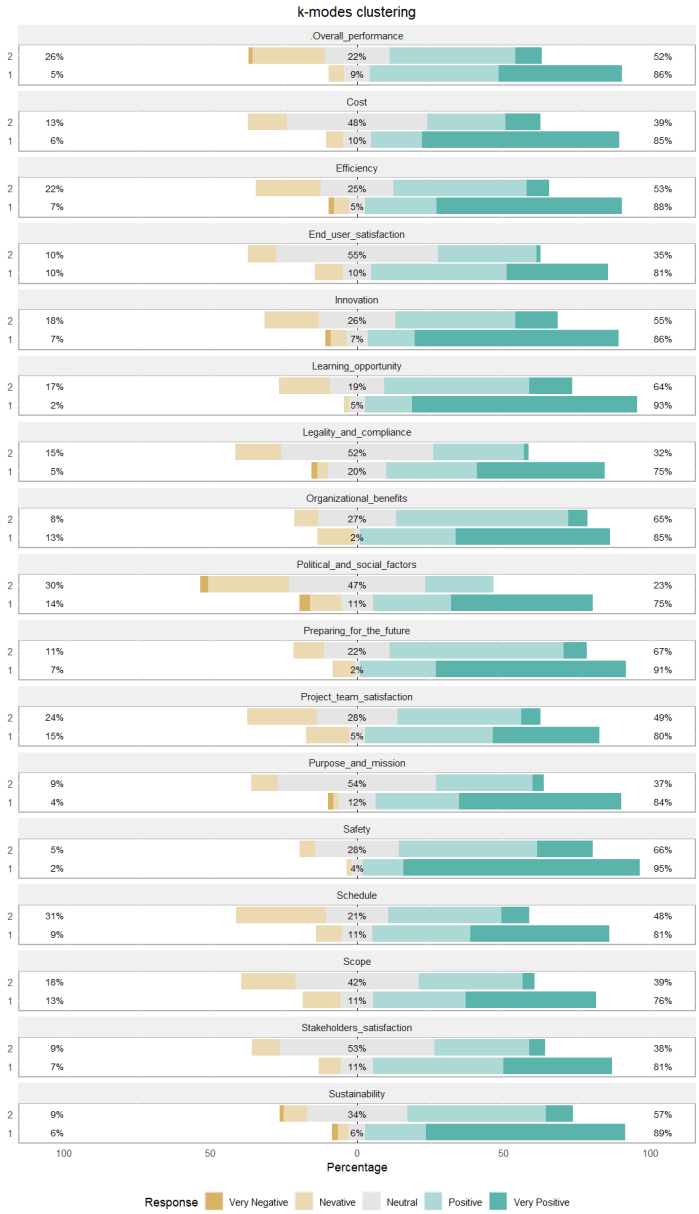


Figure 10 – Segmented criteria by cluster.

of respondents who have an exclusive workplace for themselves, contributing to their overall better performance. Lastly, the comparison based on the quality of internet networks reveals a slight increase in the proportion of dissatisfied respondents with their networks in Cluster 2. The consolidated table provides a more concise and organized representation of these insights, making it easier to interpret the data holistically.

Table 3 – Profiles present in each Cluster.

Variable and Variants	% Respond. in Cluster 1	% Respond. in Cluster 2
Role in Projet Team		
Team Member	56.9%	54.5%
Project Manager	43.1%	45.5%
Gender		
Male	72.4%	77.9%
Female	27.6%	22.1%
Marital Status		
Single	8.6%	24.7%
Married	79.3%	74,00%
Divorced	12.1%	1.3%
Responsible for eldery or children		
Yes	58.6%	53.2%
No	41.4%	46.8%
Workplace sharing		
Dedicated	58.6%	53.2%
Shared	41.4%	46.8%
Internet Quality		
Suitable	91.4%	88.3%
Unsuitable	8.6%	11.7%

4.6 Consolidating the analysis

To consolidate the analysis performed, Table 4 was organized with the research question, analysis technique, and main conclusions.

Comparing the findings of priority with the proposed model of De Souza et al. (2022a) for determining the relative importance of the criteria based on a multi-criteria technique (AHP), the top five criteria identified are: 'Learning opportunities', 'Scope', 'Innovation', 'Cost', and 'Purpose and Mission'.

As this is a recent experience, there is great opportunity in the specialized literature to reflect on the 'permanent' consequences of the emergency adoption of remote work. Some first works (Kifor et al., 2022; Nolan et al., 2021; Pillai & Prasad, 2022) indicate that, after the pandemic, the system can continue as a mode of work, taking into account the nature of the work to be done and the personal conditions of the participants. There is a tendency for the work mode to remain, even if in combination with face-to-face or hybrid work.

Our work indicated better perceived performance of workers who had tutoring, without checking the age or degree of dependence on the tutor. Such absence of information may explain the difference to the findings of Kifor et al. (2022) who indicated that having young children in the house (6 years or younger) has a negative impact on technical performance, on the other hand,

Table 4 – Consolidation of analysis.

Question	Analysis performed	Comments
Q1	Bibliographic survey	Was identified in specific literature the frequent criteria used to evaluate project success
Q2	Histogram	Most of the participants (66%) perceived positive or very positive influence of telecommuting on overall project success
Q3	Overall Likert Order	Overall performance scored positive or very positive in 65% of the responses provided. The evaluations had a positive balance in all criteria
Q4	Segmentation by role in the project	It was observed that project managers evaluated more positively the overall performance in relation to political factors, legality, compliance, and political and social factors. On the other hand, team members reported a more positive impact on sustainability criteria and learning opportunities.
Q4	Segmentation by gender	In all criteria, female respondents registered more positive influence responses than male respondents
Q4	Segmentation by responsibility for the elderly and children	Observed prevalence of more positive influence for respondents who were responsible for the elderly or children.
Q4	Segmentation by marital status	Perceived, for all criteria, more positive responses in the following order: 1 divorced, 2 married, and 3 single.
Q4	Segmentation by workplace use	Perceived more favorable performance for respondents who had an exclusive workplace compared to those who shared it with another resident.
Q4	Segmentation by adequate internet availability	The quality of the available internet affected the performance of the project, with an advantage for respondents who had good internet network, but only 9.7% are subject to less than desirable internet quality
Q5	Polychoric Correlation	The correlation index of the individual criteria showed that the following 5 highest correspondence with the global performance: Efficiency (0.78), Purpose and mission (0.68), Scope, stakeholders and Project team satisfaction (0.62), Schedule (0.61)
Q6	Clustering k-modes	Cluster 1 outperforms Cluster 2, observing the same advantage to the profiles observed in the profile-by-profile segmentation

there was convergence on the benefits of an adequate infrastructure for performing remote work (internet and dedicated workspace). The study of Kifor et al. (2022) also found that employees who work from home are more likely to adapt to the new working environment and develop routines and strategies that allow them to work productively, compared to those employees who only occasionally turn their homes into offices.

In line with our work, Pillai & Prasad (2022), discussing differences by gender, found that also that women employees benefit from flexible working as the main success factor highlighted. The article also indicated that productivity increased throughout, but in the extended phase of

teleworking. Especially those oriented towards technology faced health risks, burnout and job attrition.

Nolan et al. (2021); Pillai & Prasad (2022) suggest that adopting a hybrid approach, with the appropriate ratio of home and office working, is a balanced solution. Nolan et al. (2021) highlights that this allows developers the flexibility to adapt to their personal needs, while maintaining face-to-face interaction and effective collaboration with the team. Also registered that this hybrid approach can lead to a better work-life balance, increased productivity, higher employee satisfaction and better overall performance.

Pillai & Prasad (2022) emphasizes the importance of Human Resources (HR) interventions, specifically through effective training programs, to optimize the management of full-time remote work and promote a positive work experience in both full-time and hybrid work settings. By implementing these interventions, organizations can build on the productivity potential of their employees and promote a culture of flexibility and adaptability.

Some of our findings could not be compared with the recent literature, because the profiles of respondents by ”role in project” and ”marital status” were not discussed in the documents we found and analyzed.

5 CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

We surveyed the recurring criteria in the literature for evaluating project success, which we list here: time, cost, scope, efficiency, mission/purpose, organizational benefits, future-proofing, stakeholder satisfaction, political and social impact, legality and compliance, safety, and sustainability.

We found that the perceived influence of telecommute was positive on the overall success of the project, where 66% of the respondents indicated a positive (4) or very positive (5) influence.

The analysis using the Likert package of criteria indicated the following ordering of perceived influence and their corresponding percentages of positive (4) or very positive (5) influence evaluations: ”Safety” (79%), Preparation for the future (77%), Learning opportunity (74%), Organizational benefits (70%), Sustainability (68%), Efficiency (68%), and Overall success (66%).

The perception of influence on project success varies by distinct respondent profiles. For instance, male participants, unmarried respondents, individuals without children or elderly dependents, those lacking a dedicated workspace, and project managers perceive telecommuting to have a less favorable impact on project success.

By the polychoric correspondence analysis, we observed higher rates of correspondence with the global success criteria: ”Carrying out the project efficiently,” Meeting the project’s purpose and mission, Satisfaction of the project’s stakeholders, Satisfaction of the project team, and Accomplishment of the project in the desired scope, respectively.

In the cluster analysis using k-modes, we observed clustering data according informed perceptions of influence in all criteria, the higher presence of profiles that had a less positive impact on project performance within Cluster 2, witch is the one with lower perceived influence on project success. This suggests that the multivariate effect aligns with the individual segmentation of each profile variable.

The main objective of this article was to analyze the experiences of individuals who were involved in a project and had to make a rapid transition to remote working due to the COVID-19 pandemic. By achieving the main objective of this study, we successfully identified the segmentation of profiles that require more support for projects and measures to support future rapid transitions to a remote working model, preserving and even increasing the performance of the projects they are involved in.

The findings of this paper can support the development of customized project continuity plans, especially in situations that necessitate rapid transitions to telecommuting, by tailoring strategies and approaches to address the specific requirements of different participant profiles, organizations can enhance project outcomes and effectively navigate future scenarios involving telecommuting.

Regarding the limitations of this study, we recognize that there was limited participation from Asian and African respondents, which may have impacted the extension of the findings. To obtain more robust results, a broader sample should be considered. Additionally, it is important to highlight that the trajectory of the pandemic varies across regions, as do the stringency of social isolation measures implemented. These regional differences should be taken into account when interpreting the results.

We propose the following suggestions for future research to address the limitations: increase diversity in the sample by including Asian and African respondents, expand the sample size to enhance result extension, consider regional variations in the pandemic curve and social isolation measures, assess the impact of cultural factors on remote work, and conduct longitudinal studies across different pandemic phases to understand evolving experiences and implications.

By addressing these suggestions, future research can contribute to a more comprehensive understanding of the impact of remote work during the COVID-19 pandemic, while mitigating the limitations mentioned in this study.

We also pointed as limitation of our study and suggestion for future research to employ logistic regression to assess the probability of individual group membership, providing a more detailed understanding of group categorization. Additionally, the application of Gaussian mixture models could offer valuable insights into clustering patterns. Furthermore, increasing the sample size should be considered, with the objective of identify nuances in the data analysis, thereby enhancing the robustness of the findings and their extension to a broader context.

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