INFLUENCE OF QUALITY MANAGEMENT ON COST PERFORMANCE OF CONSTRUCTION PROJECTS: A CASE OF LIFTS AND ESCALATOR COMPANIES, KENYA

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ABSTRACT

The rise in urbanization has significantly affected the growth of various industries, including the construction industry. Continuous population growth in major cities has led to an increase in the need for quality infrastructure and housing. This phenomenon has been associated with an increase in the number of construction companies, as well as related activities in equal measure. Advancements in the construction industry and the utilization of space vertically have necessitated the installation of lifts and escalators in tall buildings. Project performance is measured against several metrics, key among them being the quality of the deliverables, the time taken to complete the project, and the cost performance indices. A common problem faced in implementing projects is cost overruns. This problem is often associated with some underlying causes such as poor quality, resource, and stakeholder management. This study focused on the influence of quality management practices on the aspect cost performance of lift and escalator projects in Kenya. The study assumed a descriptive research design, with the target population being employees from the 36 registered lift and escalator companies in Kenya. Particularly, the study's sample contained project managers charged with the responsibility of existing lift installation projects undertaking by the outlined companies. A census study was implemented and included all the project managers from the 36 lift companies in Kenya. Descriptive and inferential statistics were used in the computer-aided data analysis in Statistical Package for Social Sciences (SPSS). Collected data was analyzed and presented in tables, graphs and percentages. The study implemented the linear regression model in depicting the dependent variable as an equation of the independent variable to facilitate predictions of changes in the outlined variables. The numerical measures of central tendency which are mean, dispersion and standard deviation were used in summarizing the collected data. Calculation of the questionnaire's internal consistency revealed an alpha value of .94, which ascertained the reliability of the data collection tool. The study revealed a significantly strong positive relationship between quality management and the cost performance of lift and escalator projects. The respondents noted that all the elements of quality management, that is, planning, assurance, and control, impact the cost performance of projects. From the study's findings, the respective companies should focus their efforts on the management of resources.

Key Words: *quality management, cost performance, construction projects, lifts and escalator companies, Kenya*

INTRODUCTION

Construction projects are significantly affecting most economies around the world and as such, the aspect of deliverability is essential. Abbot and Marohasy (2014) argue that if the numerous investments in construction projects do not provide the required return, then the sustainability of

activities such as urbanization and globalization is threatened. The return on investment of the projects is rated in metrics such as project deliverability, acceptance by stakeholders, the optimization of the limited resources, and the capacity to achieve the initial requirements (Kibowen, 2018). These metrics are also used in defining modern-day projects in most industries. An appropriate combination of these metrics enhances the performance of the outlined projects. Globally, the number of companies that manufacture, supply, and maintain lifts and escalators have gradually increased over the recent past. This increase is associated with a rise in demand, number, and complexity of construction projects.

Lifts are a means of public transport for people and goods, especially, in tall buildings. In the construction industry, lifts and escalators are used as machines that reduce the workers' efforts during their day-to-day operations. Lifts are also used in the manufacturing and transport industries, which include ports (Kibowen, 2018). Urbanization in various parts of the world has led to a change in the structural designs, thereby making lifts and escalators a necessity for increased cost-effectiveness and better space optimization. Similarly, Kenya has witnessed a significant increase in construction projects, which include infrastructure and skyscrapers, over the recent past. According to Kemei, Kaluli, and Kabubo (2016), this increase is attributed to the growth of the population seeking additional settling space and the dynamics of economics, with the underlying factor being urbanization. Regulatory bodies, including the National Construction Authority (NCA), implement laws that ensure the lifts and escalators are safe to use by adhering to outlined regulations. These regulations are categorized under plant and equipment in construction for clarity and increased compliance.

According to Aluoch and Iraki (2018), lift and escalator companies have experienced significant growth due to increased investment in the construction industry, especially infrastructure and real estate. The companies can be divided into various categories that include maintenance and service and new machinery. Although there have been significant changes with regard to investments in the construction industry, the high cost of lifts and escalators has presented the industry with a major challenge. Kibowen (2018) explains that the advancements in technology are accompanied by an increase in the cost of production, especially for research and development of equipment. Lack of skilled labor and management of safety are some of the other challenges that are common to the industry. Today, China has made significant contributions to the global Escalator markets in consumption, as well as production. Global Escalator companies have investments in China, as sole proprietorships or partnerships (Kiguru, 2018).

The Chinese market experienced a decline in the sale of construction plant and equipment in 2015 and 2016 (Hui & Yeung, 2016). This decline was associated with a drop in the real estate market and a larger number of plant and equipment-related accidents. Kiguru (2018) observes that the outcomes of the decline affected the smaller companies whose capital was low due to reduced sales volumes and unstable customer bases. The larger companies with robust competitiveness were able to withstand the outlined downturn in the industry. Most companies turned to

maintenance to sustain individual operations. Hui and Yeung (2016) explain that the shift to maintenance was strategically beneficial since the Chinese market has over 4 million installed machines. Exports of construction plant and equipment from China is expected to rise by 8% from 2017 – 2020, which is an estimated USD2.120 billion worth of exports (Subash, & Gunasekaran, 2018). This phenomenon is associated with the significant growth of companies such as the Shanghai Mitsubishi Company Ltd. The plant and equipment market will be worth an estimated USD 120.2 billion by 2021. The market is currently controlled by companies such as KONE (Finland), FUJITEC Ltd (Japan), Schindler (Swiss), United Technologies (US), Thyssenkrupp (Germany). The Asia Pacific region is the largest market for construction plant and equipment, followed by Europe and North America, because of the large population that warrants the need for resource-intensive real estate projects.

In Kenya today, there are about eleven international companies and forty local companies in the market. The NCA has published good performance records from these companies and compliance with safety measures that have been outlined based on a mandate by the law (Gacheru, 2015). However, several fatal accidents over the years have tainted the performance image of the companies by lowering their safety indices. This phenomenon has significantly reduced the deliverability of construction projects Most of the competitive international companies are involved in modernization projects, considering that they are credited for most of the older installations. The companies also take up new installation projects in new buildings, as well as service and maintenance. Local companies are popular for the sole distribution of plant and equipment and spare parts acquired from Chinese and other European companies. Kemei, Kaluli, and Kabubo (2016) explain that local companies face challenges in taking up resource-intensive projects due to the financial commitment involved. As such, the local companies are left to scrap for the smaller projects while the multinationals take up the bigger share of lift and escalator installation projects in the construction industry.

Safety has always been a major priority to building owners and contractors operating within the construction industry. Unfortunate accidents on site have led to the loss of lives and incapacitation. Besides these fatalities, contractors are slapped with heavy fines by the government for their noncompliance with safety, which is often termed as negligence (Kibaara, 2014). The safety issue has led to improvements in safety policies to match international standards. Quality is another fundamental project metric that goes a long way in maintaining a competitive advantage in any free market. However, Kemei, Kaluli, and Kabubo (2016) argue that construction companies and consumers of construction projects have different perceptions of quality. In this internet age that is characterized by simplified access to information, most consumers are more knowledgeable on the desired outcomes from construction and as such, they have greater expectations. These demands from customers are incorporated into project requirements to enhance the acceptability of outcomes amidst the heavy competition (Aden, Nzulwa, & Kwena, 2016). A common definition of quality for both contractors and customers encompasses the cost-effectiveness of projects. This cost-effectiveness is defined in terms of time and financial resources.

According to the Energy Regulatory Commission (ERC) (2018), there are a total of 36 lift, escalator, and general contractor companies in Kenya. These companies collaborate with other construction firms in installing lifts and escalators to buildings that have been completed. The association between lift and escalator and construction companies is mutual. In some instances, construction companies outsource the role of installing lifts to independent companies for improvement in the general quality of outcomes (Kemei, Kaluli & Kabubo, 2016). The relationship between lift companies and the construction industry has facilitated the concurrent implementation of projects. As such, it is common for the factors affecting the performance of lift and construction projects to be similar.

PROBLEM STATEMENT

The growth of the construction industry has been characterized by the completion of enormous projects. These projects are associated with the high intensity of resources and costs. This phenomenon does not discredit the fact that project resources are scarce. Cost overruns are a common occurrence, especially in developing countries, even with the high growth rate of construction projects (Kogi & Were, 2017). A report by the Africa Development Bank revealed that some construction projects had cost overruns of more than 100% (Tejale, Khandekar & Patil, 2015). Several studies have been completed in an attempt to identify some of the factors affecting the cost performance of projects (Kogi & Were, 2017; Basu, 2014). Patil (2019) explains that cost overruns are caused by a wide range of factors that project managers can manage effectively. Cost being a part of the iron triangle of projects implies that deviation from the budgeted estimates is perceived as poor performance. Choge and Muturi (2014) explain that a solution to exceeding budgetary allocations entails strictly adhering to cost estimates provided in the project planning stages. However, sticking to these estimates proves to be difficult, especially with the continuous use of prototypes and iterations in projects. Factors such as quality and stakeholder management significantly influence the minimization of cost overruns (Mubila, Moolman, Zyl, Kokil & Lufumpa, 2014). Cost is a key element throughout a project's life cycle. Cost overruns still cause setbacks in the performance of projects, despite the significant improvements that have been made in project management practices. These setbacks in project performance adversely affect the attainment of sustainable development, return on investments, and meeting the stakeholder needs, among other things. Therefore, it was imperative to look further into the problem with the intent of adding to the existing body of knowledge and finding a solution. This study focused on the influence of quality, resource, and stakeholder management on the cost performance of lift projects by reducing unnecessary overruns. Generally, the study sought to examine the influence of quality management on the cost performance of lift projects in Kenya.

GENERAL OBJECTIVE

The general objective of the study was to examine the influence of quality management on the cost performance of construction projects in Kenya.

THEORETICAL REVIEW

Theory of Constraints- Cost Performance

The theory of constraints (TOC) was developed by Eliyahu M. Goldratt in 1984 in an attempt to assist organizations in attaining their goals. The underlying assumption of the theory is that organizations are controlled and measured using the metrics of inventory, operational expense, and throughput (Woeppel, 2016). Inventory refers to finances utilized in making necessary purchases. Throughput is the generation of money through sales. Operational expense is the money used in the conversion of inventory to throughput. Cost-effectiveness is a goal for both profit and non-profit organizations. The necessity of a goal or a condition is based on the comprehension of financial efficacy based on operating expense, inventory, and throughput. The premise of the theory is based on the fact that goal attainment is limited by at least one constraint, which is perceived as the limiting factor. According to Ikeziri et al. (2019), the theory proposes continued development on the identified constraint to a point in which it does no longer limit goal attainment.

The tools presented by the theory include the five focusing steps, the thinking processes, and throughput accounting. The focusing steps provide an approach used to identify and eliminate constraints. Thinking processes promote analysis and resolution of problems (Levinson, 2019). The strength of the theory is based on the fact that it prioritizes approaches to improvement made towards attaining desired goals, with the top priority being an existing constraint. Optimizing time while focusing on non-constraints does not increase the significance of goals attainment. The five steps of eliminating constraints include identifying, exploiting subordinating, elevating, and repeating the entire process (Woeppel, 2016).

The TOC appeals to the cost performance variable of the study. The goal for projects in lift and escalator companies encompasses improving the cost performance. In the TOC's five focusing steps, the first step entail identification of the constraints. The constraints to achieving cost performance in lift and escalator projects include quality, resource, and stakeholder management. Based on the TOC, these constraints should be prioritized to enhance optimization of each one in the attainment of project cost-effectiveness.

Deming's Theory - Quality Management

Dr. Edward Deming's approach to total quality management is premised on the Shewhart cycle, the system of reflective knowledge, and the fourteen management points. The Shewhart cycle encompasses the Plan-Do-Check-Act (PDCA) model that was established to inspire continuous improvement (Bartošová, & Hrašková 2015). Planning entails the definition of desired outcomes or objectives, and the subsequent actions or activities. Notably, quality planning entails predicting the uncertainties of the future based on available data. Doing is the implementation of outlined actions and process improvements. Checking is the process of ensuring that the outcomes match

the initial objectives that were pre-defined in the planning stage. Weerasinghe and Thisera (2016) argue that quality assurance is implemented in the checking stage where the outcomes are scanned against the improvement requirements to determine the resulting efficacy. Acting entails the determination of whether there is a need for change before resuming planning all over again.

Deming's system of reflective knowledge entails system appreciation, knowledge variation, knowledge theory, and psychological knowledge. Corbacioglu (2016) elucidates that system appreciation is the comprehension of the activities in the organization, and in this case, project management. Variation entails accounting for any changes, and the underlying factors that contribute to the changes. Knowledge theory encompasses what can be known while psychological knowledge entails a clear comprehension of human nature. Noteworthy, Bartošová and Hrašková (2015) argue that psychological knowledge is responsible for the allocation of roles based on the expertise, attitudes, experiences, and motivation of the members in project teams. These roles define the utilization of project resources in the attainment of quality outcomes. In project management, Deming's theory is a broad representation of the nature of projects and how they are required to change. Bartošová and Hrašková (2015) associate the provisions of the theory to other works such as the systems theory and conceptual pragmatism. All projects are varied and this variability facilitates the understanding, and subsequent implementation of the desired change.

Deming's theory applied to the quality management variable of the study. Quality management is essential in determining what is acceptable, or not, in terms of the project outcomes. Akhwale and Ombui (2018) explain that inadequate planning limits the deliverability of projects because the project uncertainties cannot be managed. Managers need to exercise better planning for improved deliverability of projects. Nyaga (2014) asserts that poor planning leads to the mismanagement of the resources of time and cost. Nyambura (2015) elucidates that project outcome, and the subsequent measures should be defined for improved deliverability of construction projects. Omeno and Sang (2018) argue that value control should be included in the process of planning and budgeting for the effective utilization of resources.

EMPIRICAL REVIEW

Quality management ensures that projects achieve the metrics defined at the start of the project, especially, in the planning phase. The metrics of the project are the deliverables included in the project goals, and the subsequent strategies to attain the outlined goals (Rumane, 2017). Project managers are responsible for defining and communicating, the standards under which the outcomes of the project will be measured. Basu (2014) explains that the scope of quality management relies on the deliverables defined by the project manager. Additional quality metrics include cost controls and the delegation of responsibilities.

Akhwale and Ombui (2018) researched to examine the factors that significantly affected leadership skills in construction performance, a case of construction companies operating in Nairobi. The

specific objectives included the effect of project planning skills, communication skills, risk management, and monitoring and evaluation on the performance of construction projects in construction companies in Nairobi County. The study assumed a descriptive research design and the target population comprised of 111 employees working in construction companies. A sample of 33 respondents was selected from the target population. The primary data collection instrument was questionnaires with qualitative and quantitative research being utilized in data analysis. The resulting outcomes were presented in a tabular format. The study revealed that inadequate planning skills and the complexity of project planning limited the efficacy of project performance in the construction companies under study. The constraints of cost and time increased the intricacies of project management practices, which heightened the need for quality planning.

Omeno and Sang (2018) conducted research to explore the extent to which project management impacted the performance of construction projects, a case of Constituency Development Fund (CDF) projects in Migori East. The specific objectives of the study included examining the influence of contractor experience, procurement procedures, factors affecting project management, and cost on the performance of construction projects in Migori East. A descriptive research design was used in targeting 26 active projects in Migori East. The resulting target population from the selected projects was 62 respondents who comprised of 12 contractors, 24 consultants, and 26 clients. A census survey was conducted that involved the target population. Questionnaires were used for the collection of primary data and the resulting quantitative data was analyzed using descriptive statistics.

The study revealed that the cost performance of construction projects was fashioned by pressure situations while proprietors were affected by agenda overruns, value, risk, and complexity. The expenses and design requirements varied because of the weather and market trends. The elements of project management defined the quality of the initiatives. The conception phases entailed the identification of project management elements. Procurement processes were essential in improving the performance of the construction industry. Limiting the number of bidders in the procurement process increased the risk with regard to stakeholder relations. The experience of contractors was based on their reliability, information, and credibility. The study recommended that value control should encompass the procedures in planning, budgeting, and the control of expenses. Project management components should be defined earlier in the planning process to improve the efficacy of project completion. Procurement systems facilitate the attainment of a project's mission. All the activities should be clearly defined for better credibility with regards to the perception of all stakeholders.

Nyambura (2015) conducted research to examine the factors that influenced the completion of construction projects in Kenya. The research adopted a descriptive research design with the target population comprising of 136 managers drawn from Nairobi County's Ministry of Land and Urban Development. The primary data collection instrument was questionnaires with the questions being both closed- and open-ended. The questionnaires were administered through the pick and drop

method. Face-to-face interviews were also conducted to obtain additional primary data from the respective Ministry. Qualitative and quantitative approaches to data analysis were utilized with the resulting data. The quantitative approach entailed the utilization of descriptive statistics, that is, percentages and frequencies, in tabular format. SPSS was used in computer-aided coding and the subsequent data analysis. The study revealed a positive relationship between human-related (0.529), project management (0.622), project procedures (0.764), and business-related factors (0.638) and the effective completion of construction projects. The study recommended that there should be better clarity with regards to the measurement of project outcomes in the completion of construction projects. Project management techniques facilitate the realization of desired outcomes in projects. Technological resources provide the required motivation to the members of project management teams.

Nyaga (2014) researched to explore the impact of project management skills on the performance outcomes of construction projects, a case of construction firms operating in Mombasa County. The study focused on companies conducting major construction projects that have a significant impact on the economy of Mombasa County, and the country at large. The specific objectives included evaluating the effect of project management skills, communication skills, risk management skills, and monitoring and control on the performance of construction firms in Mombasa County. The findings of the study were significant to project managers, project owners, all sectors, scholars, and other research organizations. The study employed a descriptive research design with a sample of 33 respondents being generated from a target population of 111 employees employed with the firms under study. The primary data collection instrument was questionnaires. Data analysis consisted of both qualitative and quantitative research with data presentation being in tabular format. The study revealed that poor planning limited the efficacy of construction companies with time and cost further constraining the outcomes of construction projects. The construction firms opted for technology to improve the quality of planning.

RESEARCH METHODOLOGY

This study was a quantitative research that was implemented through data collection and analysis. Noteworthy, the study implemented a descriptive research design. The study collected, analyzed, and presented data to account for the "how" and the "what" in research. Numerical outcomes are better off in statistically providing improved decision-making capacities even with the lack of definitions or explanations (Lewis, 2015). The target population of research refers to the set of subjects or elements that the study will explore based on interest in their attributes. Etikan, Musa, and Alkassim (2016) suggest that the attributes of these elements should be similar. The target population consisted of employees in the lift and escalator companies registered in Kenya. As aforementioned, there is a total of 36 lift companies registered by the ERC (ERC, 2018). The 36 project managers of these companies composed the sample of the study. The collection of primary data is essential in the study in determining the interactions between the variables of interest to the study. The various data collection instruments include questionnaires, direct observations,

interviews, and focus groups. This study utilized questionnaires as the chief source of collecting primary data. Krosnick (2018) observes that questionnaires are tools that effectively collect quantitative data because they are useful in the gathering of standardized data, as well as making generalizations. Besides, the responses are quick since they reach a large number of respondents over a given period of administration. Caution was exercised in designing the questionnaires to ensure that the answers from the respondents were not manipulated (Patten, 2016). Subsequently, the design of the questionnaire was a depiction of the objectives of the study that were defined by the specified study variables. The choice of questionnaires was based on convenience in terms of cost and time required in collecting large volumes of data. The fact that questionnaires could contain both open- and closed-ended questions implies that they were the perfect instrument for collecting quantitative and qualitative data (Smout, Davies, Burns & Christie, 2014). Since this study focused on quantitative data, the questionnaire consisted of closed-ended questions only. Likert scales present respondents with ranked choices for them to express variations in terms of the degree to which they perceive a particular question. The scales present respondents with additional choices and as such, they counter the limitation of closed-ended questions that are associated with a reduced amount of collected data. The downside of ordinal data resulting from Likert scales is the limited statistical measures that could be applied in data analysis. For instance, mode is the most suitable measure of central tendency for ordinal data because of the restrictions against the use of mean. However, researchers have not excluded the use of mean as a statistical measure of central tendency on ordinal data (Nemoto, &Beglar, 2014). Since mean is the most common measure of central tendency and "supports" measures of dispersion such as standard deviation, the study applied it in the analysis of the quantitative data from the Likert scale. The study utilized Statistical Package for the Social Sciences (SPSS) in data analysis. The analysis included the use of both descriptive and inferential statistics. On the one hand, descriptive statistics utilize summaries in describing the attributes of the population. Notably, the statistics use tables, graphs, percentages, and the numerical measures of central tendency, that is mean, and dispersion, that is, the standard deviation, in describing data. On the other hand, inferential statistics make predictions and inferences about the occurrences in a population-based on the sample data collected.

RESEARCH RESULTS

The study revealed that the current state of lift and escalator projects is not as bad, considering its coefficient in the regression model. However, this phenomenon could be changed through the accurate implementation of the variables explored by the study. The nature of competition and projects in the construction industry requires constant innovation in the implementation of quality, resource, and stakeholder management. The "big" foreign lift and escalator companies have significant investments in cost performance, which accounts for the deliverability of their projects. This phenomenon should be emulated by other local companies to facilitate the execution of the widely-scoped elements. Most of the respondents agreed that quality, resource, and stakeholder

management significantly affect the cost performance of lift and escalator projects. As such, the continuous examination of the study variables will impact future projects significantly.

The study revealed a significantly strong positive relationship between quality management and the cost performance of lift and escalator projects. The respondents noted that all the elements of quality management, that is, planning, assurance, and control, impact the cost performance of projects. Planning facilitates the establishment of the measures that will be used to determine the nature of outcomes. For the most part, these measures are associated with the owners' requirements or the organizations' strategic objectives. Since all projects are time-based efforts, the goals of the organizations might change from time to time. As such, it is essential to outline project measures before execution to ascertain the attainment of the desired quality. Noteworthy, the respondents agreed that quality management had a significant impact on budgetary allocations. This phenomenon is associated with the fact that certain elements, such as owners' requirements, should be addressed to the latter to facilitate improved buy-in of the outcomes. The respondents also agreed on the impact of government-based reports on the cost performance of projects. These reports are primarily based on the analysis of lift and escalator projects against government requirements. The recommendations of these reports should also be implemented to facilitate the attainment of quality based on the government's perspective and requirements.

In addition, the linear regression model was used in presenting the relationship between quality management and project cost performance. Table 1 illustrates the model that was used to depict the association between the explanatory and scalar response variable.

Table 1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.690[a]	.577	.402	.4229008

a. Predictors (Constant) Quality

The outlined value of R is 0.690, which indicates a strong positive relationship between the study variables. R Square, 0.577, indicates that the variables that were utilized in the study account for 57.7% of the factors affecting the cost performance in lift and escalator projects.

Table 2: ANOVA[a]

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	3.419	3	1.140	6.372	.003b
Residual	3.756	21	.179		
Total	7.175	24			

b. Dependent Variable: Performance
c. Predictors: (Constant), Quality

The ANOVA (Analysis of Variance) table is fundamental in studies that include the testing of the hypothesis. Noteworthy, the F calculated is measured against the value of F tabulated to determine the hypothesis to reject. However, the table was included in the study because of the P-value. The value of .003 is less than .05, thereby ascertaining the reliability of the regression in depicting the dependent variable in the form of the independent variable.

Table 3: Regression Coefficients

Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1 (Constant)	.434	.059		3.996	.001
Quality	.168	.417	.340	.359	.723

a. Dependent Variable: Performance

According to the regression model outlined above, the current cost performance of lift and escalator projects, while holding all the study variables constant is .434. Raising quality management by the unit will affect the cost performance of the projects by a factor of .168.

CONCLUSION

Cost performance is a metric that is used in the measurement of the financial effectiveness of a project. Financial effectiveness entails achieving more outcomes with limited resources. The cost performance metric has become popular within lift and escalator companies, and the construction industry as a whole, owing to the fierce competition, as well as the nature of the market. Particularly, the competition aspect inspires continuous innovation to facilitate the optimization of scarce financial resources. Innovations should be completed along the lines of quality, resource, and stakeholder management to improve the deliverability of lift and escalator projects.

Quality is the ability of a project to achieve all its goals. These goals are identified or outlined as part of the planning process before the execution of a project. Quality management is an essential element in project management since it affects cost performance. The outlined elements of planning, assurance, and control effectively improve the cost performance of projects. There are various approaches used in determining the quality aspect of any project. These approaches include using government regulations, owners' expectations, and organization objectives. Since all the approaches are essential, it is fundamental to account for them in the process of determining the quality of a project.

RECOMMENDATIONS

From the study's findings, the respective companies should focus their efforts on the management of resources. Notably, automation through the adoption of technology would improve the

outcomes of resource management. Information systems would be used to effectively identify, and subsequently address, team members' skill gaps before the allocation of roles. This phenomenon would ensure that all team members have skills that match the requirements of projects. Moreover, data-based resource allocation would improve the accuracy and effectiveness of resource management. Data would assist lift and escalator companies in making accurate projections, especially during budgeting processes. In general, technology would improve stakeholder management through seamless collaboration and quality management through combination with all the respective aspects.

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