

Prioritization of Human Resource Development Criteria on Success Indicators in Building Projects

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ABSTRACT

In terms of purpose, this research is an applied one; and in terms of method, it is a survey one. Given that project success is general, this study attempts to assess key success indicators in building projects through reviewing the related articles and expert interviews, and then identify them by reviewing the related articles and expert opinions on project human resource development criteria. In order for a more accurate evaluation, a separate questionnaire was drawn up for each success indicator, and the developmental impacts were prioritized based on the project success indicators. The first questionnaire was distributed among 52 specialists and the second one among 47 specialists. Data analysis was performed using the SPSS software. Six key success indicators in building projects were obtained from the results and the data analysis showed that human resource development played a positive role in all key success indicators; each criterion, however, had a different level of impact on the indicators.

KEYWORDS

Building projects, HRD criteria, Human resource impact, Key success indicators

1. INTRODUCTION

Human resources are people in work organizations who map out general goals and priorities, plan job processes, manufacture goods and services, track efficiency, allocate financial resources, and sell products and services (Bratton et al., 2017). Human resources are among an organization's most important resources and are vital to its success, as competition between organizations to attract efficient human resources has become fierce (Törstena et al., 2020; Obeidat et al., 2018). Human resources are a key component in all organizations, as the better the human resource performance, the better the organization's overall performance. Therefore, an organization must have good employees to complete the required tasks (Andry et al., 2020). Human resource activities improve the success of the organization. This suggests that if organizations are to grow their entrepreneurial activities, they will give priority to HR departments and promote their practices. Efficient workplace planning

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allows a company to recognize and prepare how existing and future workplace issues and goals are tackled (Al-Qudah et al., 2020). The most important challenge of project resource management is human resource management. Human resources greatly influence the cost and time of the project. The shortages of human resources gradually increases time and cost the project (Karthick, et al., 2020).

Given the crucial role of human resources, the aim of this article is to examine the role of HRD in the success of building projects. The role and importance of the human resource is more widely understood nowadays, hence there has been a lot of research on manpower performance in the construction industry over the last decade. However, since the construction industry including all construction projects such as those for the construction of dams, motorways, airports, refineries, etc. is expanding, each of these projects has different requirements. Therefore, this study focuses exclusively on building projects in the construction industry to obtain results that are more accurate.

Abhishek stated that construction industry makes a significant contribution to the national economy and provides employment to large number of people. Human resource management plays an important role in the process of project management. Human Resource Management can be done at International construction as well as at the project level (Abhishek A. et al.2017).

Given the complexity and vastness of building projects, success cannot be achieved without developing an appropriate method for planning and developing project labor force. In today's highly competitive world, one of the key elements of success is to increase productivity. Therefore, as the labor force develops and productivity improves, the success rate can be increased (Yeganeh, 2007). According to research, training and development of human resources is one of the most important aspects of human resource management, but it is often overlooked as a trivial activity at many organizations. By defining competence requirements and staff development in a team environment through training, construction companies can ensure that their employees have the skills needed to deal with the complex and challenging construction industry (Awad, 2015). A.Satish made a study on evaluation of human resource management. He made a Questionnaire survey from the employees of different construction companies of different levels and it is analyzed with the AHP Model. His findings revealed that Cost is majorly considered by the employees in construction

projects with respect to profits of the projects. Time is important in construction projects next to cost (Satish. A, et al., 2018). Gudiene identified the key success factors in construction projects. In this study, 71 key success factors were measured by 15 construction industry experts from 5 companies with sufficient knowledge and experience in project management. The data was processed on the basis of the experts' assessments, and on the basis of the published results for one of the 10 key factors, the motivations of project team members were listed (Gudiene, 2013). In another study, Abdullah presented a framework that examined the impact of six human resource management practices (training and development, teamwork, compensation, human resource planning, performance evaluation, employee safety) on the performance of a construction organization in Malaysia. It turned out that all 6 measures had a positive impact on the company's performance and improved staff performance, project quality, and organizational flexibility (Abdullah.z, 2009). Oferzwikael conducted a study on human resource management in the project team. The study focused on the effect of the length of project on the effectiveness of HRD implementation. The results showed that the development of the project team not only had a significant impact on the success of the project but also affected the business goal of the organization. However, they considered that the project implementation length was very important and the effectiveness of HRD was higher in long-term projects than in short-term ones (Oferzwikael, 2010). Adnane carried out a study on the factors influencing the success of a project in terms of the impact of human resource management. The study showed that there was a significant relationship between project success and staff factors. The results showed that the relationship between the independent variables and the success of a project varies according to the project life cycle. Furthermore, the type of organizational structure (task-based, project-based, and matrix-based) as well as the support of personnel by the management correlated with the success of the project (Adnane, 2004). Asif Khan in a study concluded that employment, training and

development, performance evaluation, employee compensation and engagement had a significant impact on the performance of construction companies (Asif Khan, 2010). According to a research by Othman, improving the quality of operations depends on the training of not only the project team but also the employees and task forces. The results of the project study conducted in Malaysia indicated that not only contractors' agents but also project stakeholders, including consultants and employers' representatives, had to receive required trainings (Othman, 2012).

M. Harsha states that improper resource utilization impacts on various costs, profit margins, quality of the projects, on time completion etc. Critical constructional delays cause high impact in project such as loss of profit margin and time over run. Due to stakeholder's delay 63% of the projects face uncertainty. This is due to the lack of early phase attention and also industrial culture. 70% of delay in execution by equipment is due to operators. 40% of the projects face depicts of skilled manpower. Employing unskilled labours leads to uncertainties more critical and even it leads to rework (Harsha et al.2017).

Therefore, project team members play an important role in the success of a project throughout the period of the project. There are several characteristics that make the project team members competent. These characteristics include technical knowledge and skills, communication skills, problem solving abilities, teamwork skills and commitment to their job. All the above mentioned characteristics of project managers and project team members are essential for the achievement of success in a specific project (Shen, Tang, 2017). Teamwork has become very important in the recent era as most of the tasks can only be done in the form of teams in organizations. Organizational development refers to the growth and development of an organization because of the innovative and latest techniques used by them for various processes and procedures involved in the production of products and provision of services (Harasim, 2017). The results of the analysis revealed that HR practices and organisational performance in construction companies were significantly and positively related, and that training and development and performance appraisal have a significant and positive relationship with organizational performance (RatebJ,et al.2020).

As mentioned above, the success of a building project depends on the efficiency of the human recourse, so HRD is directly linked to the success of the project. However, since there are many factors linked to the development of the human recourse. The first question to be answered is which development criterion has the greatest impact on project success indicate. The first step is therefore to identify key success indicators in a building project. However, before defining the critical success indicators, we define HRD in order to enhance our understanding of the concept.

2. HUMAN RESOURCE DEVELOPMENT

There have been many discussions about human resource development, but the important point is that, according to Dilworth's research, the definition of labor force development is very difficult and no comprehensive definition has yet been given. For this reason, the research provides several definitions by the experts of the field: According to Werner, human resource development is a systematic set of activities planned by the organization to provide employees with the skills necessary to promote current and future careers (Werner, 2006). According to Swanson, it is a process of human resource development through organizational development and special training and development to improve performance (Swanson, 2001). Backer believes that the purpose of human resource development is for the organization to survive and to facilitate the process of adapting and changing methods and policies within the organization. Human resources development is a process including diagnosis, prevention and treatment (Backer, 2006). Given the research, human resource development is the process or procedure of organized capacity and ability based on experience by the staff over a period of time to improve individual and organizational performance and cultural, economic and social growth (Cunningham & Lynham, 2006). Human resource development usually involves the five most important factors i.e. personal development of a person, career development of an employee, team

development of a team consisting of many individuals, organizational development of a company and training, and development process of employees working in a particular organization (Waters & Craske, 2016). The concept of human resource development refers to the idea of developing and utilizing human skills and knowledge by the development of an organization and the development and training of the employees of that particular organization with the goal of improvement and increase in the organizational performance (Jermsittiparsert, Siriattakul, & Wattanapongphasuk, 2019).

In view of the above, it can be concluded that the aim of human resource development is to improve the individual and group performance of employees in all aspects in order to achieve success in the project.

3. METHODOLOGY

The study is an applied research in terms of the results and a descriptive survey in terms of obtaining the required data. The following methods were used in this study:

1. Questionnaire survey – stage 1: a questionnaire survey was carried out to identify the key success indicators in building projects (more details in section 3-1).
2. Questionnaire survey – stage 2: a questionnaire survey was carried out to identify human resource development criteria (more details in section 3.2).
3. Data analysis: this section includes 3 subsections, namely, Cronbach's alpha test, the Kolmogorov-Smirnov test, Pearson correlation test, and Friedman test (more details in section 4).

3.1 Success Indicators in Building Projects

The concept of critical success factors was first introduced by Ronald Daniyel in 1961. He said that the best way to run an organization is to identify success factors. In other words, success factors are the ones that, if properly controlled, guarantee the success of a project. Then, in 1972, Rockart introduced the critical success factors (CSFs) as “a limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. (Rockart, 1978 & Daniyel, 1961). Then, for a long time until the mid-20th century, the most important success factors of a construction project were the three factors of time, cost and quality, and to assess the success of the project, these three factors were considered as the golden triangle (Abdullah, 2006). Since many scientists believe that these three criteria cannot be achieved, experts have introduced other factors during the last decade (Kylindri, 2012). The table below describes it. According to the indicated cases and in-depth interviews with connoisseurs, 13 indicators were identified as success indicators of the building project:

1-Cost 2-scheduling 3-Quality 4-Scope 5- Performance and function 6- Operator and Stakeholder satisfaction 7-HSE 8- Market share and competition 9- Predictability and sustainability of the project, 10-Profitability and return of Capital, 11 - Innovation and uniqueness of project, 12 - Experience gained, 13- Project impact on climate, community and culture. The indicators were distributed through a questionnaire among 32 experienced professionals (3 with PhD degrees, 8 PhD students, and 21 with Masters Degrees). In total, about 40% of the questionnaires were given in person and 60% through e-mail and facsimile. The questionnaire was qualitative and the experts had to determine the relevance of each indicator (very important, important, medium, low and very low) based on their experience. The success indicators in building projects were prioritized as follows:

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1-Cost 2-scheduling 3-Quality 4-Scope 5- Performance and function 6- Operator and Stakeholder satisfaction 7-HSE 8- Market share and competition 9- Predictability and sustainability of the project,

Table 1. Success factors for construction projects

No.	Author	Year	Success indicators
1	Pinto&slevin	1988	Cost, Time, Performance, Satisfaction, Use, Effectiveness
2	Freeman&Beala	1992	Technical performance, Efficiency of project execution, Managerial and organizational implications, Personal growth, Project termination, Technical innovativeness , Manufacturability and business performance
3	Lim& Mohamed	1999	Cost, Time, Quality, Customers' satisfaction, HSE, Profitability, Efficiency of project
4	Bryde& Robinson	2005	Cost, Time, Meeting the technical specification, Customers' satisfaction, Stakeholders, satisfaction.
5	chan	2004	Cost, Time, Quality, stakeholders' satisfaction, Efficiency of project
6	Ahadzie	2008	Cost, Time, Quality, Customers' satisfaction, HSE
7	Elattar	2009	Cost, Time, Quality, performance of project, return of Capital, Market competition, Customer Satisfaction
8	Bahi&Farias	2010	Cost, Time, Quality, Scope, Customer Satisfaction, Safety, Team Satisfaction, Shareholder Satisfaction.
9	Altmeey& Abdulrahman	2010	Cost, Quality, Time, Customer Satisfaction, Technical Specifications, and Functional Requirements, Revenue and Profits, Competitive Advantage, Market Share, Reputation
10	Gomsa& Romao	2010	Cost, Time, Technical Requirements, Customer Satisfaction, Objectives Achievement
11	Khosravi& Afshar	2011	Time Performance, Cost Performance, Quality Performance, Health, Safety and Environment (HSE), Client Satisfaction
12	Mukhtar& Amirudin	2016	Client's satisfaction, Project completed on time, Project completed to specified quality standard, Absence of disputes, safety, Completion within budget
13	Omer& Haleema	2017	Quality, Time, Cost, Health, Safety and Environment (HSE), Scope, Customer' Satisfaction, Efficiency of use resource, Effectiveness Productivity, Profitability, Shareholder satisfaction, Experience gain from the project, Achievement of project's objectives, Sustainability, Reliability

10-Profitability and return of Capital, 11 - Innovation and uniqueness of project, 12 - Experience gained, 13- Project impact on climate, community and culture.

The indicators were distributed through a questionnaire among 52 experienced professionals (3 with PhD degrees, 8 PhD students, and 41 with Masters Degrees). In total, about 40% of the questionnaires were given in person and 60% through e-mail and facsimile. The questionnaire was qualitative and the experts had to determine the relevance of each indicator (very important, important, medium, low and very low) based on their experience. The success indicators in building projects were prioritized as follows:

Diagram 1: Prioritize success indicators in building project

According to the prioritization, six indicators have gained important (score more than 4), so these indicators are introduced as success indicators in building projects:

-Cost 2-Quality 3-scheduling 4-Profitability and return of Capital 5-Operator and Stakeholder satisfaction 6- Scope

Therefore, in the following, we will discuss the impact of human resource development criteria on the six mentioned indicators.

3.2 Human Resource Development Criteria

The review of the HRD research showed that, despite the many efforts to define the criteria for HR development, no comprehensive indicators covering all aspects of HR development have been presented so far. Here are some things to do:

As stated, most researchers believe that training, motivation and participation are the most important criteria in human resource development. However, these factors are the main criteria and should be divided into more sub-criteria. In this research, documents and records as well as field study methods were used to obtain human resource development

Criteria, and an interview with the experts was used to obtain the sub-criteria. In other words, information obtained from the review of important articles was processed by the experts attending the interviews. As a result, after performing the above items, the following table was obtained (3 main criteria, 21 sub-criteria):

3.3 Study Population

Due to the extend statistical population, an attempt has been made to select it purposefully. Therefore, the focus of the study was on reputable construction companies that have carried out large and complex building projects. Hence statistical population research includes the senior managers of 60 Grade 1 building companies in Tehran city. The experts have at least a master’s degree and at least 15 years’ of experience in building projects. An attempt has also been made to send most of the questionnaires in person to answer questions posed personally to the experts (Approximately 70% of the questionnaires were answered through face-to-face conversation and 30% of the questionnaires were answered via email and fax). In order to use all points of view, questionnaires were sent out to all project stakeholders, including the contractor, consultant, client, and especially project managers

Table 2. The most important criteria of human resource development

Row	Author	Publication Year	Result
1	Tabasi	2009/2011	The most important factor in the development of human resources is the development of training programs and motivation in human resources.
2	Yatagana	2010	The most important components of project team development are training, and motivating at all levels (operational and non-operational) of the project team.
3	Ried	2006	Four strategies have been proposed to develop the workforce: targeting organization policy, creating career opportunities for all, creating learning opportunities, continuous communication with a leading university
4	Adan	2004	Factors Influencing Human Resource Development in Concrete Construction Projects: Education - Welfare
5	Bradlit	2010	Development factors include job promotion - job environment - job justice - job conditions and job security.
6	Liu	2007	One of the most important factors in improving the performance of the project team is motivation, to be motivated by competence-based promotion.
7	Zardacks	2014	The most important goal of human resource development is to provide motivation and effective communication between employees and managers.
8	Niveen	2014	Factors affecting HRD: Education, motivation, leadership style, employee commitment, support of HR initiatives

Table 3. Human resources development criteria

Row	Criteria	Sub-Criteria
1	Training	T ₁₌ Specialized Knowledge Training
		T ₂₌ Trainings related to managerial and professional skills (Problem Solving Power, Proper Decision Making, Crisis Management, etc.)
		T ₃₌ Personal Skills Training (Being responsible, honest, etc.)
		T ₄₌ Training related to organizational culture and value(Getting to know the organization's goals, culture and company rules ...)
2	Motivation	M ₁₌ Job security and job stability
		M ₂₌ Proportionality of labor and salary (Fairness of Payment)
		M ₃₌ Timely payment of salaries
		M ₄₌ Appropriate system of welfare and facilities
		M ₅₌ Appropriate system of encouragement and punishment
		M ₆₌ Appropriate career path
		M ₇₌ Meritocracy and Non-Discrimination (Job Fairness)
		M ₈₌ proper working environment conditions
3	Participation	P ₁₌ Employee Satisfaction with Managers and Partners
		P ₂₌ Effective communication and collaboration between managers and employees
		P ₃₌ Independence and delegation of authority to do things
		P ₄₌ Good employee involvement in decision making
		P ₅₌ Appropriate sharing of information between employees
		P ₆₌ Good organizational culture and good collaboration between employees
		P ₇₌ clarity in task description and good cooperation among staff
		P ₈₌ support and correct evaluation of the staff by the manager
		P ₉₌ division of tasks and authority
		P ₁₀₌ Employee Satisfaction with Managers and Partners

and Human resource managers. Each expert was presented with six questionnaires and they were asked to comment on each of the sub-criteria based on their experience, using a 5-point Likert scale (very important, important, medium, low and very low). The statistical distribution of Respondents' age is as follows:

Table 4. Respondents' age range

Age	Work Experience	Respondent's profession	Number	Percent
Up to 35 years	Up to 12 years	technical expert	5	10.6%
36 to 45 years	12 to 20 years	Project manager	29	61.7%
46 years and up	20 years and up	Project manager or Managing Director	13	27.66%

4. DATA ANALYSIS

4.1 Reliability of the Research Questionnaire

The reliability or consistency of the questionnaire means that if the measured items (of the same tool) are measured again under the same conditions at different times, the results will be approximately the same. Accordingly, the Cronbach's alpha coefficient, one of the most common methods of measurement, was used here. The closer the coefficient is to 1, the more significant is the internal correlation of the questions and thus the more homogeneous the questions are (Coefficient above 70% is acceptable). (The Cronbach's alpha coefficient for each of the success factors in a building project are as follows:

Diagram 2: Indicators reliability test

According to the results in the above table, Cronbach's alpha coefficients for all indicators are more than 0.7. Therefore, the reliability of the questionnaire is acceptable.

4.2 Normality Test

In this section, to test the normality of the research variables, the Kolmogorov-Smirnov test was used.

To check the normality of the data, we tested the initial assumption that the data distribution is normal at the level of 0.05. Therefore, according to the results in the above table (test statistics are more than 0.05), the distribution of data is normal. In the following, we will examine the relationships between human resource development criteria and success indicators. Due to the fact that the distribution of data is normal, the Pearson test is used.

4.3 Correlation Test

As the results in the table above show, the number corresponding to the significance level of the test in all cases is less than 0.05. Also, given that the Pearson correlation coefficients for all variables are more than 0.6, so there is a strong correlation. Therefore, it can be claimed that the human resource development criteria (training, motivation and participation) play a significant role in the success indicators in building projects.

Table 5. One-sample Kolmogorov-Smirnov Test

Indicators	Output	Output	Participation	Motivation	Training
cost	Test Statistic	Test Statistic	0.129	0.118	0.120
	Asymp. Sig. (2-tailed)	Asymp. Sig. (2-tailed)	.05 ^c	.099 ^c	.085 ^c
quality	Test Statistic	Test Statistic	0.121	0.126	0.121
	Asymp. Sig. (2-tailed)	Asymp. Sig. (2-tailed)	.081 ^c	.055 ^c	.079 ^c
schedule	Test Statistic	Test Statistic	0.127	0.093	0.122
	Asymp. Sig. (2-tailed)	Asymp. Sig. (2-tailed)	.055 ^c	.200 ^{c,d}	.072 ^c
scope	Test Statistic	Test Statistic	0.129	0.107	0.127
	Asymp. Sig. (2-tailed)	Asymp. Sig. (2-tailed)	.051 ^c	.200 ^{c,d}	.054 ^c
return of Capital	Test Statistic	Test Statistic	0.129	0.124	0.128
	Asymp. Sig. (2-tailed)	Asymp. Sig. (2-tailed)	.051 ^c	.057 ^c	.051 ^c
Stakeholder satisfaction	Test Statistic	Test Statistic	0.103	0.120	0.120
	Asymp. Sig. (2-tailed)	Asymp. Sig. (2-tailed)	.200 ^{c,d}	.088 ^c	.088 ^c

Table 6. Pearson correlation test

Indicator	Output	Participation	Motivation	Training
cost	Pearson Correlation	.847**	.835**	.807**
	Sig. (2-tailed)	0	0	0
quality	Pearson Correlation	.799**	.652**	.607**
	Sig. (2-tailed)	0	0	0
schedule	Pearson Correlation	.804**	.826**	.834**
	Sig. (2-tailed)	0	0	0
scope	Pearson Correlation	.855**	.836**	.842**
	Sig. (2-tailed)	0	0	0
return of Capital	Pearson Correlation	.832**	0.912**	0.903**
	Sig. (2-tailed)	0	0	0
Stakeholder satisfaction	Pearson Correlation	0.802**	0.86**	0.871**
	Sig. (2-tailed)	0	0	0

** : Correlation is significant at the 0.01 level (2-tailed)

4.4 Friedman Test

The Friedman test is a nonparametric test which we use to compare the mean rankings between variables. Before ranking the variables, we test the Chi-Square. The larger the Chi-Square, the greater the difference in rankings. If the difference between the means is zero or the value of the test statistic is small, all three variables have the same distribution or mean. As can be seen, the Chi-Square of the numerical test is large, so the differences in the ranks of the main criteria of the research are significant.

As can be seen, the number corresponding to the significance level of the Friedman ranking test is at an acceptable level; therefore, it is found that 95% probability of ranking between variables is significant. The following table shows the ratings of each of the main variables in

Table 7. Friedman test for cost indicate

Cost Indicate	Scheduling Indicate
N	47
Chi-Square	36.142
df	2
Asymp. Sig.	.000

Table 8. Friedman test for Scheduling indicate

Cost Indicate	Scheduling Indicate
N	47
Chi-Square	31.537
df	2
Asymp. Sig.	.000

Table 9. Friedman test for quality indicate

Quality Indicate	Scope Indicate
N	47
Chi-Square	41.85
df	2
Asymp. Sig.	.000

Table 10. Friedman test for scope indicate

Quality Indicate	Scope Indicate
N	47
Chi-Square	52.87
df	2
Asymp. Sig.	.000

Table 11. Friedman test for satisfaction indicate

Operator and Stakeholder satisfaction indicate	Profitability and return of Capital indicate
N	47
Chi-Square	32.23
df	2
Asymp. Sig.	.000

Table 12. Friedman test for capital indicate

Operator and Stakeholder satisfaction indicate	Profitability and return of Capital indicate
N	47
Chi-Square	18.133
df	2
Asymp. Sig.	.000

comparison with the research. In order to prioritize the research criteria as much as possible, in the following tables, we describe the ranking of each of the criteria and sub-criteria of human resource development:

4.5 Ranking of Criteria and Sub-Criteria

- **Cost indicate:**
 - **Criteria:** training (2.61), motivation (2.01), participation(1.38)
 - **Sub criteria:** 1- Training related specialized knowledge and Training related managerial, 2- meritocracy and non-discrimination 3- Proportionality of labor and salary

- **Scheduling indicate:**
 - **Criteria:** training(2.65), motivation (1.68), participation(1.67)
 - **Sub criteria:** 1- Training in technical and management skills 2-Specialized Knowledge Training, 3- Good employee involvement in decision making
- **Quality indicate:**
 - **Criteria:** training(2.63), motivation (2.06), participation(1.31)
 - **Sub criteria:**1-Specialized Knowledge Training 2- Meritocracy and Non-Discrimination 3-Training in technical and management skills.
- **Scope indicate:**
 - **Criteria:** training(2.69), participation (2.1), motivation (1.21)
 - **Sub criteria:** 1-Training related to organizational culture and value. 2- Good employee involvement in decision making. 3- Training in technical and management skills and Effective communication and collaboration between managers and employee.
- **Operator and Stakeholder satisfaction indicate:**
 - **Criteria:** participation (2.46), training (2.18), motivation (1.36)
 - **Sub criteria:** 1- Good employee involvement in decision making 2- Effective communication and collaboration between managers and employee 3- Meritocracy and Non-Discrimination.
- **Profitability and return of Capital indicate:**
 - **Criteria:** participation (2.44), training (1.99), motivation (1.57)
 - **Sub criteria:** 1- Good employee involvement in decision making 2- Effective communication and collaboration between managers and employee 3- Meritocracy and Non-Discrimination.

5. CONCLUSION

The aim of the present study was to show that human resource development criteria play an important role in the success of building projects. The results showed that the HRD is of above-average importance for all six success factors in building projects (average total score: 3.81). Especially, 3 indicators of cost, schedule and project quality are of high importance and 3 indicators of the satisfaction of beneficiaries and the return on investment and the scope of the project are of upper-average importance. These results show that the development of human resource is directly related to the success of building projects. Data analysis also showed that the impact of HRD metrics was different for each of the building project success indicators, so that, for example, training may not provide the same feedback for all project success indicators. To achieve each of the success indicators, it is therefore necessary to focus on the effective factors of the indicator. The prioritization of the criteria revealed that the training criterion is the most important among the 4 indicators of cost, scheduling, quality and project scope, and the participation criterion for profitability and stakeholder satisfaction. The data analysis also revealed that the following five sub criteria are the most important and influential factors for human resource development among the success indicators in building projects:

1. Specialized knowledge-based training
2. Management-related skills training
3. Meritocracy and non-discrimination (labor justice)
4. Adequate participation of staff in decision-making
5. Effective communication and cooperation between managers and employees

According to the above prioritization, after sub-criteria of training, the second rank is related to the sub-criteria of meritocracy and non-discrimination. The issue of job justice is one of the most important issues in human resource management which, according to research findings, has a very important role in achieving success in building projects. Lack of meritocracy demotivates employees, and no matter how skilled the workforce is, it does not have the motivation to work compassionately, so

the right efficiency is not achieved. The Data output also shows that the most important sub-criterion in the participation factor is the adequate participation of staff in decision-making and effective communication and cooperation between managers and employees. This indicates that the staff's decision making and effective communication of managers with employees causes the problems and executive cases to be transferred from the bottom to the top in the best possible way (without intermediaries and wasting time). Therefore, managers solve the relevant problems as soon as possible and prevent crises. According to the mentioned contents, it is recommended that project managers have adequate funding for staff training and also spend more time communicating with employees.

Finally, due to the importance of the issue, it is suggested that researchers study the role of HRD criteria in other civil projects such as dams, roads, tunnels, etc.

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